Cabarrus County,
North Carolina

Construction & Demolition Debris
Landfill Phase 1L Expansion Project

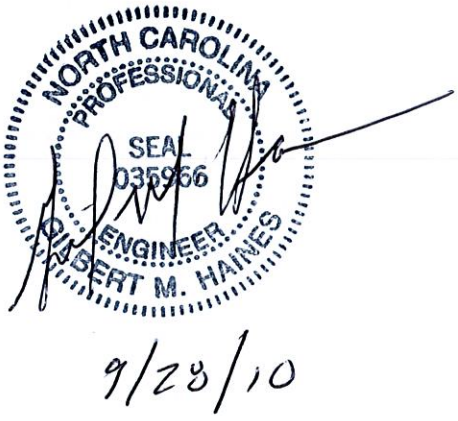
September 2010

Project Manual

SECTION 00002

CERTIFICATION PAGE

CIVIL



9/28/10

Camp Dresser & McKee
5400 Glenwood Avenue, Suite 300
Raleigh, North Carolina 27612
Tel: (919) 787-5620 Fax: (919) 781-5730

Cabarrus County,
North Carolina

Construction & Demolition Debris
Landfill Phase 1L Expansion Project

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CabarrusCounty
The Center of American Motorsports
NORTH CAROLINA

Project Manual

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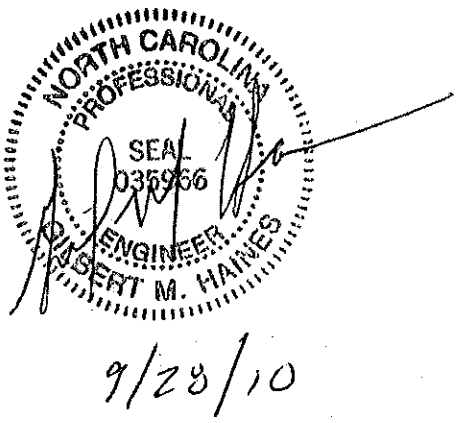

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END OF SECTION

NOTICE TO BIDDERS

Sealed proposals will be received by Cabarrus County Purchasing in the Board of Commissioners Meeting Room located in the Cabarrus County Government Center, 2nd Floor, 65 Church Street SE, Concord, North Carolina 28026-0707, up to 2:00 p.m. on October 20, 2010 and immediately thereafter publicly opened and read for the furnishing of labor, material and equipment for the construction of the Cabarrus County Construction and Demolition Debris Landfill Phase 1L Expansion. The Work to be performed under this Contract generally includes the construction of a 2.1 acre double-lined cell area. Work is to include the installation of a 40-mil HDPE base liner, geocomposite drainage net, a 10-inch secondary soil drainage layer and 24-inch protective soil drainage layer. Protective cover and secondary drainage layer material shall be obtained from an offsite borrow source with a specified permeability of $5x10^{-5}$ cm/sec or greater. Work shall include stripping existing vegetation, preparing the liner subgrade and liner installation, as well as a leachate collection system with force main, erosion control measures, seeding and mulching and other incidentals as shown on the Drawings and as noted in the Specifications. The Owner's onsite borrow area will be available for liner subgrade preparation and miscellaneous soil needs. Sorting and processing of the onsite borrow soil may be needed. Work may also include the construction of a Subcell A area within the lined expansion. This will depend on the need for permitted airspace for waste disposal prior to overall project completion. Days will be added to the date of Substantial Completion if this option is selected. In addition, work will also include the construction of a leachate tank truck loading area. A 150,000 gallon leachate storage tank system (including secondary containment, piping, transfer pump, etc.) shall be included as a bid alternate.

Bids received after the specified bid date and time will not be accepted. The time of receipt shall be determined by the clock in the Cabarrus County Board of Commissioners Meeting Room. The sealed envelope containing the bid shall be marked on the exterior "Cabarrus County Construction and Demolition Debris Landfill Phase 1L Expansion" with the name, address, and North Carolina Contractor License Number of the Bidder. The sealed envelope shall be addressed to Cabarrus County Purchasing Attention: Ms. Sherri Barnhardt, Finance Department, Cabarrus County Government Center, 2nd Floor, 65 Church Street SE, Concord, North Carolina 28026-0707.

Complete contract documents will be open for inspection on or after September 29, 2010 at the Cabarrus County website @ www.cabarruscounty.us, as well as at the landfill office and in the offices of the Engineer or may be purchased from the Engineer upon receipt of a One Hundred Dollar ($100.00) deposit in cash or certified check made payable to CDM. Only complete sets of the Contract Documents will be issued. This payment represents reproduction costs and is non-refundable. Costs include first class postage or equivalent only.

The Cabarrus County Construction and Demolition Debris Landfill Phase 1L Expansion shall be substantially complete as defined in the General Conditions within **120 calendar days** of the date fixed by the Notice to Proceed. As stated above, the date of Substantial Completion shall be extended to **140 calendar days** of the date fixed by the Notice to Proceed, should the option to construct the Subcell A area be implemented.

A non-mandatory Pre-Bid Meeting will be held on Tuesday, October 6, 2010 at 2:00 p.m. in the maintenance building at the entrance to the Cabarrus County Landfill located at 4441 Irish Potato Road. Bidders will have the opportunity to inspect the project site following the pre-bid meeting. Bidders are also welcome to contact Mr. Rick Payne, Solid Waste Director at (704) 920-2955 to arrange for a site inspection of the proposed work area prior to the submittal of bids.

Questions regarding the intent of the work must be submitted in writing to CDM's Raleigh, NC office: Attention Mr. Robert Brossoie, P.G. on or before the close of business on October 15, 2010. Appropriate

responses, where required, will be issued by addendum to all plan holders prior to the date scheduled for the submittal of bids.

All bids must be accompanied by a certified check, cashier's check, or bid bond in the amount of 5 percent of the total bid amount made payable to Cabarrus County. Said deposit shall be retained by the Owner as liquidated damages in the event of failure of the successful bidder to execute the contract within ten days after the award or to give satisfactory surety as required by law.

No bid may be withdrawn for sixty (60) days after the scheduled closing time for bids.

Cabarrus County reserves the right to reject any and all bids and to waive any formality.

Signed: CABARRUS COUNTY

By: _____
Cabarrus County Purchasing Agent

ENGINEER: CDM
5400 Glenwood Avenue, Suite 300
Raleigh, NC 27612
Phone: (919) 787-5620
Fax: (919) 781-5730

INSTRUCTIONS TO BIDDERS

For a Proposal to be considered, it must be in accordance with the following instructions:

1. PROPOSALS

Proposals must be made on the Bid Proposal Forms provided herein, and all blank spaces for Bids, Alternates and Unit Prices, applicable to bidder's work, shall be properly filled in. When requested Alternates are not Bid, the Proposal may be considered non responsive. The Bidders agree that Bids submitted on the specified Bid Proposal Forms, which are detached from these specifications, will be considered and will have the same force and effect as if attached thereto. Numbers shall be stated both in writing and in figures for the Base Bids and Alternates.

Any modification to the Bid Proposal Forms (including Alternates and/or Unit Prices) may disqualify the Bid and may cause the Bid to be rejected.

The Contractor shall fill in the Bid Proposal Forms as follows:

A. If the documents are executed by a sole Owner, that fact shall be evidenced by the word "Owner" appearing after the name of the person.

B. If the documents are executed by a Partnership, that fact shall be evidenced by the word "Co-Partner" appearing after the name of the partner executing them.

C. If the documents are executed on the part of a Corporation, they shall be executed by either the President or the Vice-President and attested to by the Secretary or Assistant Secretary in either case, and the title of the office of such person shall appear after their signatures. The seal of the Corporation shall be impressed on each signature page of the documents.

D. If the Proposal is made by a Joint Venture, it shall be executed by each member of the Joint Venture in the above form for sole Owner, Partnership, or Corporation, whichever form is applicable.

E. All signatures shall be properly witnessed or attested to as applicable.

F. Each proposal shall be addressed as indicated in the Advertisement for Bids and shall be delivered, enclosed in an opaque sealed envelope, marked "Proposal" and bearing the name of Project, name and address of the Bidder, the Bidder's license number and, if applicable, the designated portion of the Work for which Bid is submitted.

G. It shall be the specific responsibility of the Bidder to deliver the Bid to the proper official at the appointed place and prior to the announced time for the opening of Bids. Late delivery of a Bid for any reason, including delivery by the United States Mail, shall disqualify the Bid.

H. Modifications of previously deposited Bids or requests for withdrawal will be acceptable only if delivered in person or in writing to the place of the Bid opening prior to the time for opening Bids.

I. Unit Prices quoted in the Proposal shall include overhead and profit and shall be the full compensation for the Contractor's cost involved in the work.

J. The Bid Form of Proposal shall contain an acknowledgement of receipt of all Addenda including the numbers and dates.

2. COPIES OF BIDDING DOCUMENTS

A. Complete sets of Bidding Documents in the number and for the sum stated in the Advertisement for Bids may be obtained from the Engineer. This amount represents reproduction and administration costs and is non refundable.

B. Complete sets of Bidding Documents must be used in preparing Bids; neither Owner nor Engineer assume any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents, by Bidders and their sub bidders.

C. Owner and Engineer in making copies of Bidding Documents available on the above terms do so only for the purpose of obtaining Bids on the Work and do not confer a license or grant for any other use.

3. EXAMINATION OF CONDITIONS

It is understood and mutually agreed that by submitting a Bid the Contractor acknowledges his careful examination of the Bidding Documents pertaining to the work, the location, accessibility and general character of the site of the work and all existing buildings and structures within and adjacent to the site; and has satisfied himself as to the nature of the work, the condition of existing buildings and structures, the conformation of the ground, the character, quality and quantity of the materials to be encountered; the character of the equipment, machinery, plant and any other facilities needed preliminary to and during prosecution of the work; the general and local conditions; the construction hazards; and all other matters, including but not limited to, the labor situation which can in any way affect the work under the Contract; and including all safety measures required by the latest edition of the Occupational Safety Health Act and all rules and regulations issued pursuant thereto. It is further mutually agreed that by submitting a Proposal, the Contractor acknowledges that he has satisfied himself as to the feasibility and meaning of the plans, drawings, specifications, and other Contract Documents for the construction of the work and that he accepts all the terms, conditions and stipulations contained therein; and that he is prepared to work in cooperation with the Owner and all other Contractors performing work on the site. It is the responsibility of each Bidder, before submitting a Bid, to notify the Engineer of all conflicts, errors or discrepancies in the Contract Documents.

Reference is made to the Contract Documents for the identification of those surveys and investigative reports of subsurface or latent physical conditions at the site or otherwise affecting performance of the work which have been relied upon by the Licensed Professional who prepared the documents. Copies of all such surveys and reports are available to the Bidders, upon request. All Bidders are responsible for reviewing these documents prior to submission of their Bid Proposal.

Each Bidder may, at his own expense, make such additional surveys and investigations, as he may deem necessary to determine his Bid price for the performance of the work. Any on-site investigation shall be done at the convenience of the Owner. The Owner will honor any reasonable request for access to the site.

4. SUBSTITUTIONS

The Contract, if awarded, will be on the basis of material and equipment described in the Drawings or specified in the Specifications without consideration of possible substitute or "or-equal" items. Whenever it is indicated on the Drawings or specified in the Specifications that a substitute or "or-equal" item of material or equipment may be furnished or used by Contractor if acceptable to Engineer, application for such acceptance will not be considered by engineer until after the "effective date of the Agreement." The procedure for submittal of any such application and consideration by Contractor is set forth in Section 01630 of the project specifications.

5. ADDENDA

Any Addenda to the Bid Documents issued during the Bidding will be sent to each Bidder, and are to be considered covered in the Proposal and in closing a Contract they will become part thereof. It shall be the Contractor's responsibility to ascertain prior to Bid time the Addenda issued and see that their Bid includes any changes thereby required.

Should the Bidder find any discrepancies in, or omissions from, the drawings or documents or should they be in doubt as to their meaning, they should notify the Engineer, who may send written instruction in the form of Addenda to all Bidders. Only questions answered by formal written Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

All Addenda shall be acknowledged by the Bidder on the proposal form. Failure to do so may disqualify the Bid and may cause the Bid to be rejected.

6. BID SECURITY

Each Proposal shall be accompanied by a cash deposit, or a certified check drawn on some bank or trust company insured by the Federal Deposit Insurance Corporation, or a Bid Bond in an amount equal to not less than five percent (5%) of the Proposal. Said deposit to be retained by the Owner (referred to as Obligee on the Bond Form) as liquidated damages in event of failure of the successful Bidder to execute the Contract within ten (10) days after the award or to give satisfactory Surety as required by law.

The Bid Bond shall be conditioned that the surety will, upon demand, forthwith make payment to the Owner (referred to as Obligee on the Bond Form) upon the said bond if the Bidder fails to execute the contract.

7. RECEIPT OF BIDS

Bids and Bid Security shall be received in strict accordance with requirements of the North Carolina General Statutes. Prior to opening of any Bids on the Project, the Bidder will be permitted to change or withdraw his Bid as allowed by Item 1-H of these Instructions.

All copies of the Bid, the Bid security, if any, and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope. The envelope shall be addressed to the party receiving the Bids and should be identified with the Project name, time and date of Bid Opening, the Bidder's name and address, Bidder's license number and, if applicable, the designated portion of the

Work for which the Bid is submitted. If the Bid is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "SEALED BID ENCLOSED" on the face thereof.

8. OPENING OF BIDS

Upon opening, all Bids shall be read aloud. Once any Bid is opened, the Owner may return no Bids to any Bidder.

After Bids are opened, a Bidder may request that his Bid be withdrawn without forfeiting his Bid deposit in certain limited circumstances. Withdrawal after opening is permitted only if all of the following conditions specified in North Carolina General Statutes §143-129.1 are met:

A. The Bid was submitted in good faith.

B. The price Bid "was based upon a mistake, which constituted a substantial error".

C. Credible evidence is submitted showing that the error (1) was clerical in nature, as opposed to a judgment error; and (2) was actually due to an unintentional and substantial arithmetic error or an unintentional omission of a substantial quantity of work, labor, material or services made directly in the compilation of the Bid.

D. The error can be clearly shown by objective evidence drawn from inspection of the original work papers, documents, or materials used in the preparation of the Bid.

E. The request to withdraw (1) is made in writing to the public agency that invited the Proposals, and (2) is made prior to the award of the Contract, but not later than seventy-two (72) hours after the opening of Bids.

9. REJECTION OF BIDS

The Owner reserves the unqualified right to reject any and all Bids. Reasons for rejection may include, but shall not be limited to, the following:

A. If the Form of Proposal furnished to the Bidder is not used or is altered.

B. If the Bidder fails to insert a price for all Bid items, Alternates and Unit Prices requested.

C. If the Bidder adds any provisions reserving the right to accept or reject any award.

D. If there are unauthorized additions or conditional Bids, or irregularities of any kind which tend to make the Proposal incomplete, indefinite, or ambiguous as to its meaning.

E. If the Bidder fails to complete the Proposal forms where information is requested so the Bid may be properly evaluated by the Owner.

F. If the Unit Prices contained in the Bid Schedule are unacceptable to the Owner.

G. If the Bidder fails to comply with other instructions stated herein.

H. If the Bidder fails to provide all documentation confirming compliance with the North Carolina Guidelines for Recruitment and Selection of Minority Businesses for Participation in State Construction Contracts.

10. BID EVALUATION

The award of the Contract will be made to the lowest responsible Bidder as soon as practical. Should the successful Bidder default and fail to execute a Contract, the Contract may be awarded to the next lowest and responsible Bidder.

Before awarding a Contract, the Owner may require the apparent low Bidder to qualify himself to be a responsible Bidder by furnishing any or all of the following not provided in the prequalification submittal package:

A. The latest financial statement showing assets and liabilities of the company or other information satisfactory to the Owner.

B. A listing of similar completed projects of similar size, with contact persons and telephone numbers.

C. Permanent name and address of place of business.

D. The number of regular employees of the organization and length of time the organization has been in business under present name and percentage of work typically performed by the contractor's firm.

(1) Qualifications of key employees assigned to this Project.

(2) References for key employees assigned to this Project.

E. The name and home office address of the Surety proposed and the name and address of the responsible local claim agent.

F. The names of members of the firm who hold appropriate trade licenses, together with license numbers.

G. Complete list of all subcontractors and suppliers proposed.

H. Any pending arbitration or mediation cases or lawsuits. This may include all arbitration, mediation and lawsuits settled or resolved within last ten (10) years.

Failure or refusal to furnish any of the above information if requested shall constitute a basis for disqualification of any Bidder.

In determining the lowest responsible Bidder, the Owner may consider the past performance of the Bidder on construction contracts for the County of Cabarrus, the State of North Carolina or other governmental agencies. Particular concern will be given to completion times, quality of work, cooperation with other Contractors, and cooperation with the Designer and Owner.

Should the Owner adjudge that the apparent low Bidder is not the lowest "responsible" Bidder by virtue of the above information, said apparent low Bidder will be so notified and his Bid Security shall be returned to him.

The Owner shall have the right to accept Alternates in any order or combination and to determine the low Bidder on the basis of the sum of the Base Bid and the Alternates accepted.

The Owner reserves the right to reject any and all Bids, to waive all technicalities and irregularities, and to make the award as considered to be in the best interest of the Owner.

11. PERFORMANCE BOND

The successful Bidder, upon award of Contract, shall furnish a Performance Bond in an amount equal to one hundred percent (100%) of the Contract price.

12. PAYMENT BOND

The successful Bidder, upon award of Contract, shall furnish a Payment Bond in an amount equal to one hundred percent (100%) of the Contract price.

13. PRE-BID CONFERENCE

Bidders are required to attend a non-mandatory Pre-Bid Conference at the time and place stipulated in the Bidding Documents.

14. PROPOSALS TO BE BID

General Construction Work

15. QUALIFICATIONS SUBMITTALS

A. It is the intention of the Owner to award this contract to a Bidder competent to perform and complete the Work in a satisfactory manner. Accordingly, Owner will require all Bidders to submit with their Bids, 1) evidence of Bidder's certification and license to perform work in North Carolina, 2) an experience and financial statement. The Successful Bidder shall submit a Preliminary Progress Schedule within two (2) days of written request by the Owner. Bidders shall provide written documentation of experience on similar projects within the previous 5 years prior to bidding on this project. Specific experience shall include installation of a landfill base liner system. The Owner has the option of accepting or rejecting bids based on bidder's experience.

B. The Preliminary Progress Schedule shall consist of a time-scaled precedence network diagram and a narrative in accordance with appropriate formats set forth in Section 01310. Activities in the precedence network diagram shall show the order in which the Bidder proposes to perform the Work within the constraints and sequencing conditions set forth in Division 1 and shall indicate start and completion dates for key milestones and work pertaining to each division of the Specifications within each major structure of geographical area of work. Activities shall further identify work associated with significant submittals/approvals, major equipment deliveries; equipment testing, Owner's and Engineer's responsibilities, and those of affected utilities and other similarly involved third parties. This preliminary Progress

Schedule shall not replace, but serve as a basis for, the progress schedule submittals to be developed as required in Section 01310.

C. The Successful Bidder, and his surety, if any, hereby agree that any delays, within Bidder's control, in the delivery of these Qualifications Submittals will constitute a request by Bidder for an extension of time when the Bid shall remain open for the Owner's acceptance. Should Owner agree to such extension, Bidder will be required to comply with this Submittal Requirement within five (5) additional days. At the Owner's option failure by the Successful Bidder to deliver these Qualifications Submittals within the extended period will void evaluation of the Bid, and will constitute proof that the Successful Bidder has abandoned all his rights and interests in the award, and his Bid Security may be declared forfeited to the Owner as liquidated damages and the work may be awarded to another Bidder.

D. If upon receipt and evaluation of the submittals, the Successful Bidder does not pass the evaluations to Owner's satisfaction, Owner reserves the right to reject the Bid pursuant to Article 16 of the Instructions to Bidders.

16. TAXES

The Contractor shall pay all applicable sales, consumer, use and other similar taxes required by law. The Contractor is responsible for reviewing the pertinent State Statutes involving the sales tax and sales tax exemption and complying with all requirements. The Contractor shall include all Federal, State and local taxes in his bid. The Contractor shall indemnify, defend and hold harmless, Owner, Engineer and their employees, agents and representatives from and against any and all claims, damages, losses, penalties, fines and tax liabilities whatsoever resulting from Contractor's failure to include such taxes in his bid, pay any such tax or comply with any applicable tax requirements or statutes.

17. SIGNING OF AGREEMENT

When Owner gives a Notice of Award to the Successful Bidder, it will be accompanied by the required number of unsigned counterparts of the Agreement with all other written Contract Documents attached. Within fifteen (15) calendar days thereafter Contractor shall sign and deliver the required number of counterparts of the Agreement and attached documents to Owner with the required Bonds. Each counterpart is to be accompanied by a complete set of the Drawings with appropriate identification.

18. QUALIFICATIONS OF SURETY COMPANIES

In order to be acceptable to the Owner, a surety company issuing Bid Guaranty Bonds, or 100% Performance/Payment bonds, called for in these Specifications, shall meet and comply with the following minimum standards:

A. Surety must be admitted to do business in the State of North Carolina.

B. Surety shall have been in business and have a record of successful continuous operations for at least five (5) years.

C. Attorneys in fact who sign bid bonds or performance/payment bonds must file with such bond a certified copy of their power of attorney to sign such bond.

D. Agents of surety companies must list their name, address and telephone number on all bonds.

E. The life of the bonds shall extend twelve (12) months beyond the date of final payment and shall contain a waiver of alteration to the terms of the Contract, extensions of time and/or forbearance on the part of the Owner.

F. The Performance Bond shall be in an amount equal to one hundred percent (100%) of the Contract Price conditioning that the successful bidder shall comply in all respects with the terms and conditions of his Contract, and his obligations there under, including the Specifications and shall indemnify and save harmless the Owner against or from all costs, expense, damages, injury or loss to which the Owner may be subjected by reason of wrong doing, misconduct, want of care of skill, negligence or default upon the part of the Contractor, his agents, or employees, in or about the execution of performance of this Contract, including said Specifications, and shall save and keep harmless the Owner against and from all claims or losses to it or from any cause whatever, including patent infringements, in the matter of the performance of said Contract, and including also any patent infringements because of designed operation methods on the project and/or the use of any patented thing, equipment, and/or apparatus installed by him herein.

G. Whenever the Surety or sureties on the Bond so furnished shall be deemed by the Owner to be insufficient or unsatisfactory, the Contractor, within ten (10) days after notice to that effect shall furnish and deliver a new bond to the Owner in the same penalty and on the same conditions with Surety satisfactory to the Owner and this duty shall continue on the part of the Contractor, whenever and so often as the Owner shall require a new bond with a satisfactory Surety or Sureties. If the Contractor shall fail to furnish such bond, within ten (10) days after said notice is mailed to his address, the Owner through its proper agent or agents, may stop all further work under said Contract and complete the unfinished work at the expense of the Contractor.

19. NONDISCRIMINATION IN EMPLOYMENT

During the performance of this contract the Contractor agrees as follows:

The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to race, color, religions, sex, or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising, layoff or termination; rate of pay or other forms of compensation and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notice to be provided by the Local Public Agency setting forth the provisions of this nondiscrimination clause.

The Contractor will note that signing the Proposal in the Contract document constitutes certification of nondiscrimination. However, all certifications called for herein shall be executed prior to the award of contract, when applicable.

Cabarrus County shall have final authority to determine the question of compliance with these specifications.

20. COLLUSIVE BIDDING

In accordance with Section 112(c) of Title 23 USC, and General Statutes 75-5(b)(7) of the State of North Carolina, the Contractor (Bidder), by submission and execution of this bid, certifies that he has not entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with his bid on this project.

Before executing any subcontract, the successful bidder shall submit the name of any proposed subcontractor for prior approval and a sworn affidavit substantially in accordance with the preceding.

21. CONTRACT DETERMINATION - DEBARMENT

A contract will not be awarded to a Contractor that has been suspended by the State of North Carolina or any agency or department thereof for conviction or indictment or any of the offenses enumerated in the General Statutes G.S. 133-27.

Subcontracts of any tier will not be awarded to a subcontractor (or firm) that has been suspended for conviction or indictment of any of the offenses enumerated in G.S. 133-27.

22. ASSIGNMENTS

The Contractor shall not assign the whole or any part of this Contract, or any monies due, or to become due hereunder without written consent of the Owner. In case the Contractor assigns all or any part of any monies due or to become due under this Contract the instrument of assignment shall contain a clause substantially to the effect that is agreed that the right of the Assignee in and to any monies due or to become due to the Contractor shall be subject to prior liens of all persons, firms, and corporations for services rendered or materials supplied, for the performance of the work called for in this Contract.

END OF SECTION

SECTION 00300
BID FORM

PROJECT IDENTIFICATION:

CABARRUS COUNTY,
CONSTRUCTION AND DEMOLITION DEBRIS LANDFILL
PHASE 1L EXPANSION PROJECT

THIS BID IS TO BE SUBMITTED TO:

Cabarrus County Purchasing Agent
Attn: Ms. Sherri Barnhardt
Finance Office, Room 288
Cabarrus County Government Center
65 Church Street SE, Concord, North Carolina 28026-0707

1. The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Cabarrus County, herein after referred to as the County, in the form included in the Contract Documents to perform and furnish all Work as specified or indicated in the Contract Documents for the Contract Price and within the Contract Time indicated in this Bid Form and the Agreement, and in accordance with the other terms and conditions of the Contract Documents.

2. Bidder accepts all of the terms and conditions of the Bidding Documents, including without limitation those dealing with the disposition of Bid Security. This bid will remain open for sixty (60) days after the date of the bid opening. If awarded a contract, Bidder agrees to execute the Agreement and comply with all of the conditions stipulated in the Notice of Award within the time stipulated in the Notice of Award.

3. In submitting this Bid, Bidder makes all representations required by the Instructions to Bidders and further warrants and represents that:

   (a) Bidder has examined copies of all the Bidding Documents, the Advertisement for Bids, and of the following Addenda (receipt of which is hereby acknowledged):

   No. _____ Date _____
   No. _____ Date _____
   No. _____ Date _____
   No. _____ Date _____

   (b) Bidder has examined the site and locality where the Work is to be performed, the legal requirements (federal, state and local laws, ordinances, rules and regulations) and the conditions affecting cost, progress, or performance of the Work and has made such independent investigations as Bidder deems necessary.

   (c) Bidder has obtained and studied carefully all reports and drawings of subsurface conditions and drawings of physical conditions which are identified in Section 00200

of the Bidding and Contract Requirements and accepts the determination set forth in Article 4 of the General Conditions and the Supplementary Conditions thereto of the extent of the technical data contained in such reports and drawings upon which Bidder is entitled to rely.

(d) Bidder has obtained and carefully studied (or assumes responsibility for obtaining and carefully studying) all such examinations, investigations, explorations, tests, and studies (in addition to or to supplement these referred to in (c) above) which pertain to the subsurface or physical conditions at the site or which otherwise may affect the cost, progress, performance or furnishing of the Work at the Contract Price, within the Contract Time and in accordance with the other terms and conditions of the Contract Documents, including specifically the provisions of Article 4 of the General Conditions and the Supplementary Conditions thereto.

(e) Bidder has reviewed and checked all information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the site and assumes responsibility for the accurate location of said Underground Facilities.

(f) Bidder has correlated the results of all such observations, examinations, investigations, explorations, tests, reports, and studies with the terms and conditions of the Contract Documents.

(g) Bidder has given the Engineer written notice of all conflicts, errors, or discrepancies that it has discovered in the Contract Documents, and the written resolution thereof by Engineer is acceptable to Bidder.

(h) By bidding in response to this invitation, the Bidder represents that in the preparation and submission of this Bid, said Bidder did not, either directly or indirectly, enter into any combination or arrangement with any person, firm or corporation or enter into any agreement, participate in any collusion, or otherwise take any action in the restraint of free, competitive Bidding in violation of the Sherman Act (15 U.S.C. Section 1).

4. Bidder agrees to complete the Work for the following prices. The Bid Form must be completed in ink or by typewriter. Amounts shall be shown in both words and figures. In case of discrepancy, the amount in words will govern.

(a) Except as otherwise provided in this Bid Form, the Bidder represents to the County that all prices herein include all Federal, State and Local taxes. The Bidder agrees to assume responsibility for the payment of all such taxes and shall indemnify and hold harmless the County from all tax liability arising out of or related to Bidder's breach of this representation or failure to pay such taxes.

(b) Bidder understands that the County shall have the right to accept any, all or none of the proposed alternates, which require either deletion of a base bid work item from the project in its entirety or replacement of a base bid work item with another option, in any order or combination and to determine the lowest responsive Bidder on the basis of the base bid and the alternates accepted. The County reserves the right to reject any or all Bids and to waive any informality in the Bidding procedure.

ITEM NO.	DESCRIPTION	QUANTITY		AMOUNT
1	Clearing and Grubbing; the unit price of _____dollars and _____ cents ($_____) per acre	2	AC	$_____
2	Grinding of Cleared Vegetation; the unit price of_____dollars and _____ cents ($_____) per cubic yard	200	CY	$_____
3	Stripping, Transport and Stockpile of Vegetation and Organics; the unit price of _____dollars and _____ cents ($_____) per square yard	18,220	SY	$_____
4	Undercut, Transport and Stockpile of Unsuitable Materials; the unit price of _____ dollars and _____ cents ($_____) per cubic yard	250	CY	$_____
5	Undercut, Transport, and Dispose of MSW Waste at a Permitted Waste Facility; the unit price of _____dollars and _____cents ($_____) per ton	200	TON	$_____
6	Excavate, Transport, and Install Subgrade Soil from Onsite Borrow; the unit price of _____dollars and _____ cents ($_____) per cubic yard	3,700	CY	$_____
7	Furnish and Install Primary and Secondary 40 mil Textured HDPE Geomembrane; the unit price of _____ dollars and _____ cents ($_____) per square yard	22,900	SY	$_____
8	Furnish and Install Primary Composite Drainage Net; the unit price of _____ dollars and _____ cents ($_____) per square yard	11,450	SY	$_____

ITEM NO.		DESCRIPTION	QUANTITY		AMOUNT
9		Furnish and Install Secondary Sand Drainage Layer from Offsite Borrow; the unit price of _____ dollars and _____ cents ($_____) per square yard	11,450	SY	$_____
10		Furnish and Install Primary Sand Drainage Layer from Offsite Borrow; the unit price of _____ dollars and _____ cents ($_____) per square yard	11,450	SY	$_____
11		HDPE Piping			
	a	Furnish and Install 6-inch Perforated HDPE Leachate Collection Pipe; the unit price of _____ dollars and _____ cents ($_____) per linear foot	1,070	LF	$_____
	b	Furnish and Install 8-inch Perforated HDPE Header Pipe; the unit price of _____dollars and _____ cents ($_____) per linear foot	115	LF	$_____
	c	Furnish and Install 4-inch x 2-inch HDPE dual contained forcemain; the unit price of _____ dollars and _____ cents ($_____) per linear foot	645	LF	$_____
	d	Furnish and Install Leachate Cleanouts; the unit price of _____ dollars and _____ cents ($_____) per each	4	EA	$_____
12		Furnish and Install Leachate Pump Station, Sump and Valve Vault; the lump sum price of _____dollars and _____ cents ($_____)	1	LS	$_____
13		Furnish and Install Stormwater Segregation Berm; the unit price of _____ dollars and _____ cents ($_____) per linear foot	240	LF	$_____

ITEM NO.	DESCRIPTION	QUANTITY		AMOUNT
14	Furnish and Install Scrim Reinforced Tarp; the unit price of _____ dollars and _____ cents ($_____) per square yard	5,800	SY	$_____
15	Furnish, Install and Maintain Stormwater, Sediment and Erosion Control Measures; the lump sum price of _____ _____ dollars and _____ cents ($_____)	1	LS	$_____
16	Furnish, Install Precast Drop Inlet; the unit price of _____ _____ dollars and _____ cents ($_____) per each	1	EA	$_____
17	Furnish and Install 24-inch Diameter RCP Drainage Culvert; the unit price of _____ dollars and _____ cents ($_____) per linear foot	220	LF	$_____
28	Furnish and Install Temporary Seeding and Mulching; the unit price of _____ dollars and _____ cents ($_____) per square yard	16,450	SY	$_____
19	Furnish and Install Permanent Seeding and Mulching; the unit price of _____ dollars and _____ cents ($_____) per square yard	16,450	SY	$_____
20	Jet Clean and Video Inspection of Leachate Collection, and Header Lines; the unit price of _____ _____dollars and _____ cents ($_____) per linear foot	1,185	LF	$_____
21	GeoElectric Leak Location Survey; the lump sum price of _____ _____dollars and _____ cents ($_____)	1	LS	$_____

ITEM NO.	DESCRIPTION	QUANTITY		AMOUNT
22	Furnish and Install all Electrical Service, Instrumentation and Controls; the lump sum price of _____ _____dollars and _____ cents ($_____)	1	LS	$_____
23	Abandon Piezometers; the unit price of _____ dollars and _____ cents ($_____) per vertical foot	190	VF	$_____
24	Install Gas Monitoring Wells; the unit price of _____ dollars and _____ cents ($_____) per vertical foot	50	VF	$_____
25	General Onsite Excavation; the unit price of _____ dollars and _____cents ($_____) per cubic yard	3,900	CY	$_____
26	General Onsite Backfill, the unit price of _____ dollars and _____cents ($_____) per cubic yard	8,000	CY	$_____
27	Phased Subcell A Construction; the lump sum price of _____ dollars and _____ cents ($_____)	1	LS	$_____
28	Leachate Tank Truck Loading Area; the lump sum price of _____ dollars and _____cents ($_____)	1	LS	$_____
29	Geosynthetic Laboratory Services; the lump sum price of _____ dollars and _____ cents ($_____)	1	LS	$_____
30	Miscellaneous Work and Clean-up; the lump sum price of _____ dollars and _____ cents ($_____)	1	LS	$_____

ITEM NO.	DESCRIPTION	QUANTITY		AMOUNT
31	Bonds, Mobilization, and Insurance (maximum of 4% of Base Bid Amount); the lump sum price of _____ dollars and _____ cents ($_____)	1	LS	$_____
32	Indemnification (minimum $1,000.00); the lump sum price of _____ dollars and _____ cents ($_____)	I	LS	$_____

SUBTOTAL (ITEMS 1 THROUGH 32)

In Words: $_____

In Figures: $_____

33 5.0% Contingency Allowance (Base Bid): $_____

TOTAL BASE BID (ITEMS 1 THROUGH 33)

In Words: $_____

In Figures: $_____

BID ALTERNATES

34 **ALTERNATE NO. 1 – BOLTED STEEL LEACHATE STORAGE TANK**

Furnish and Install A 150,000 Gallon Bolted Steel Leachate Storage tank; the lump sum of _____ dollars and _____ cents ($_____)	1	LS	$_____

SUBTOTAL BID ALTERNATE (ITEMS 1- 32 AND 34)

In Words: $_____

In Figures: $_____

35 5% Contingency Allowance (Bid Alternate): $_____

TOTAL BID ALTERNATE (ITEMS ITEMS 1- 32, 34 AND 35)

In Words: $_____

In Figures: $_____

PROPOSED SUBCONTRACTORS:

Type	Name	Address	Type and Extent of Work

5. Bidder agrees that all Work required by the Contract Documents will be substantially completed as set forth in the Agreement (Section 00500).

   Bidder accepts the provisions of the Agreement as to liquidated damages in the event of failure to complete the Work on time.

6. The following documents are attached to and made a condition of this Bid:

   (a) Bid Security in the form of (circle one) Bid Bond/Certified Check/Cashier's Check in the amount of 5% of Bidder's Base Bid Price.

   (b) Power of Attorney (for surety bond only)

   (c) Evidence of Bidder's certification and license to perform the work and services.

   (d) Section 00480 – Non-Collusive Affidavit

   (e) Section 00420 – Qualification Form for the Contractor

   (f) Section 00421 – Qualification Form for the Steel Bolted Leachate Storage Tank Subcontractor

   (g) Section 00485 – Authority to Execute Contract

7. Communications with Bidder concerning this Bid shall be addressed to:

_____

_____

_____

_____

8. The terms used in this Bid are defined in the General Conditions of the Construction Contract, included as part of the Contract Documents and have the meanings assigned to them in the General Conditions.

(REMAINDER OF PAGE LEFT INTENTIONALLY BLANK)

9. The Bidder executes this bid as one of the following:

An Individual

By:_____ (SEAL)
(Individual's Name and Signature)

Name of Business: _____

North Carolina Registration No.: _____

Business Address: _____

_____

Telephone No.: (_____) _____

A Partnership

By:_____ (SEAL)
(Name and Signature)

Firm Name: _____ (SEAL)

North Carolina Registration No.: _____

Business Address: _____

_____

Telephone No.: (_____) _____

A Corporation

By:_____ (SEAL)
(Name of person authorized to sign and Signature)

_____
(Title)

Firm Name: _____

State of Incorporation: _____

(Corporate Seal)

Attest: _____
(Name of Secretary and Signature)

North Carolina Registration No.: _____

Business Address: _____

_____

Telephone No.: (_____) _____

A Joint Venture*

By:_____

Firm Name: _____

State of Incorporation: _____

North Carolina Registration No.: _____

Business Address: _____

_____

Telephone No.: (_____) _____

By:_____

Firm Name: _____

State of Incorporation: _____

North Carolina Registration No.: _____

Business Address: _____

_____

Telephone No.: (_____) _____

* (Each joint venturer member must sign. The manner of signing for each individual, partnership and corporation that is a party to the joint venture should be in the manner indicated above. Add additional signature blocks as necessary).

END OF SECTION

GUIDELINES FOR RECRUITMENT AND SELECTION OF MINORITY BUSINESSES FOR PARTICIPATION IN STATE CONSTRUCTION CONTRACTS

In accordance with G.S. 143-128.2 (effective January 1, 2002) these guidelines establish goals for minority participation in single-prime bidding, separate-prime bidding, construction manager at risk, and alternative contracting methods, on State construction projects in the amount of $300,000 or more. The legislation provides that the State shall have a verifiable ten percent (10%) goal for participation by minority businesses in the total value of work for each project for which a contract or contracts are awarded. These requirements are published to accomplish that end.

SECTION A: INTENT

It is the intent of these guidelines that the State of North Carolina, as awarding authority for construction projects, and the contractors and subcontractors performing the construction contracts awarded shall cooperate and in good faith do all things legal, proper and reasonable to achieve the statutory goal of ten percent (10%) for participation by minority businesses in each construction project as mandated by GS 143-128.2. Nothing in these guidelines shall be construed to require contractors or awarding authorities to award contracts or subcontracts to or to make purchases of materials or equipment from minority-business contractors or minority-business subcontractors who do not submit the lowest responsible, responsive bid or bids.

SECTION B: DEFINITIONS

1. Minority - a person who is a citizen or lawful permanent resident of the United States and who is:
   a. Black, that is, a person having origins in any of the black racial groups in Africa;
   b. Hispanic, that is, a person of Spanish or Portuguese culture with origins in Mexico, South or Central America, or the Caribbean Islands, regardless of race;
   c. Asian American, that is, a person having origins in any of the original peoples of the Far East, Southeast Asia and Asia, the Indian subcontinent, the Pacific Islands;
   d. American Indian, that is, a person having origins in any of the original peoples of North America; or
   e. Female

2. Minority Business - means a business:
   a. In which at least fifty-one percent (51%) is owned by one or more minority persons, or in the case of a corporation, in which at least fifty-one percent (51%) of the stock is owned by one or more minority persons or socially and economically disadvantaged individuals; and
   b. Of which the management and daily business operations are controlled by one or more of the minority persons or socially and economically disadvantaged individuals who own it.

3. Socially and economically disadvantaged individual - means the same as defined in 15 U.S.C. 637. "Socially disadvantaged individuals are those who have been subjected to racial or ethnic prejudice or cultural bias because of their identity as a member of a group without regard to their individual qualities". "Economically disadvantaged individuals are those socially disadvantaged individuals whose ability to compete in the free enterprise system has been impaired due to diminished capital and credit opportunities as compared to others in the same business area who are not socially disadvantaged".

4. Public Entity - means State and all public subdivisions and local governmental units.

5. Owner - The State of North Carolina, through the Agency/Institution named in the contract.

6. Designer – Any person, firm, partnership, or corporation, which has contracted with the State of North Carolina to perform architectural or engineering, work.

7. Bidder - Any person, firm, partnership, corporation, association, or joint venture seeking to be awarded a public contract or subcontract.

8. Contract - A mutually binding legal relationship or any modification thereof obligating the seller to furnish equipment, materials or services, including construction, and obligating the buyer to pay for them.

9. Contractor - Any person, firm, partnership, corporation, association, or joint venture which has contracted with the State of North Carolina to perform construction work or repair.

10. Subcontractor - A firm under contract with the prime contractor or construction manager at risk for supplying materials or labor and materials and/or installation. The subcontractor may or may not provide materials in his subcontract.

SECTION C: RESPONSIBILITIES

1. Office for Historically Underutilized Businesses, Department of Administration (hereinafter referred to as HUB Office).

The HUB Office has established a program, which allows interested persons or businesses qualifying as a minority business under G.S. 143-128.2, to obtain certification in the State of North Carolina procurement system. The information provided by the minority businesses will be used by the HUB Office to:

a. Identify those areas of work for which there are minority businesses, as requested.
b. Make available to interested parties a list of prospective minority business contractors and subcontractors.
c. Assist in the determination of technical assistance needed by minority business contractors.

In addition to being responsible for the certification/verification of minority businesses that want to participate in the State construction program, the HUB Office will:

(1) Maintain a current list of minority businesses. The list shall include the areas of work in which each minority business is interested.
(2) Inform minority businesses on how to identify and obtain contracting and subcontracting opportunities through the State Construction Office and other public entities.
(3) Inform minority businesses of the contracting and subcontracting process for public construction building projects.
(4) Work with the North Carolina trade and professional organizations to improve the ability of minority businesses to compete in the State construction projects.
(5) The HUB Office also oversees the minority business program by:
    a. Monitoring compliance with the program requirements.
    b. Assisting in the implementation of training and technical assistance programs.
    c. Identifying and implementing outreach efforts to increase the utilization of minority businesses.
    d. Reporting the results of minority business utilization to the Secretary of the Department of Administration, the Governor, and the General Assembly.

2. State Construction Office

The State Construction Office will be responsible for the following:

a. Furnish to the HUB Office a minimum of twenty-one days prior to the bid opening the following:
    (1) Project description and location;
    (2) Locations where bidding documents may be reviewed;
    (3) Name of a representative of the owner who can be contacted during the advertising period to advise who the prospective bidders are;
    (4) Date, time and location of the bid opening.
    (5) Date, time and location of prebid conference, if scheduled.

b. Attending scheduled prebid conference, if necessary, to clarify requirements of the general statutes regarding minority-business participation, including the bidders' responsibilities.

c. Reviewing the apparent low bidders' statutory compliance with the requirements listed in the proposal, that must be complied with, if the bid is to be considered as responsive, prior to award of contracts. The State reserves the right to reject any or all bids and to waive informalities.
d. Reviewing of minority business requirements at Preconstruction conference.
e. Monitoring of contractors' compliance with minority business requirements in the contract documents during construction.
f. Provide statistical data and required reports to the HUB Office.
g. Resolve any protest and disputes arising after implementation of the plan, in conjunction with the HUB Office.

3. Owner
Before awarding a contract, owner shall do the following:

a. Develop and implement a minority business participation outreach plan to identify minority businesses that can perform public building projects and to implement outreach efforts to encourage minority business participation in these projects to include education, recruitment, and interaction between minority businesses and non-minority businesses.
b. Attend the scheduled prebid conference.
c. At least 10 days prior to the scheduled day of bid opening, notify minority businesses that have requested notices from the public entity for public construction or repair work and minority businesses that otherwise indicated to the Office for Historically Underutilized Businesses an interest in the type of work being bid or the potential contracting opportunities listed in the proposal. The notification shall include the following:
    1. A description of the work for which the bid is being solicited.
    2. The date, time, and location where bids are to be submitted.
    3. The name of the individual within the owner's organization who will be available to answer questions about the project.
    4. Where bid documents may be reviewed.
    5. Any special requirements that may exist.
d. Utilize other media, as appropriate, likely to inform potential minority businesses of the bid being sought.
e. Maintain documentation of any contacts, correspondence, or conversation with minority business firms made in an attempt to meet the goals.
f. Review, jointly with the designer, all requirements of G.S. 143-128.2(c) and G.S. 143-128.2(f) – (i.e. bidders' proposals for identification of the minority businesses that will be utilized with corresponding total dollar value of the bid and affidavit listing good faith efforts, or affidavit of self-performance of work, if the contractor will perform work under contract by its own workforce) - prior to recommendation of award to the State Construction Office.
g. Evaluate documentation to determine good faith effort has been achieved for minority business utilization prior to recommendation of award to State Construction Office.
h. Review prime contractors' pay applications for compliance with minority business utilization commitments prior to payment.
i. Make documentation showing evidence of implementation of Owner's responsibilities available for review by State Construction Office and HUB Office, upon request

4. Designer
Under the single-prime bidding, separate prime bidding, construction manager at risk, or alternative contracting method, the designer will:

a. Attend the scheduled prebid conference to explain minority business requirements to the prospective bidders.
b. Assist the owner to identify and notify prospective minority business prime and subcontractors of potential contracting opportunities.
c. Maintain documentation of any contacts, correspondence, or conversation with minority business firms made in an attempt to meet the goals.
d. Review jointly with the owner, all requirements of G.S. 143-128.2(c) and G.S.143-128.2(f) – (i.e. bidders' proposals for identification of the minority businesses that will be utilized with

corresponding total dollar value of the bid and affidavit listing Good Faith Efforts, or affidavit of self-performance of work, if the contractor will perform work under contract by its own workforce) - prior to recommendation of award.

e. During construction phase of the project, review "MBE Documentation for Contract Payment" – (Appendix E) for compliance with minority business utilization commitments. Submit Appendix E form with monthly pay applications to the owner and forward copies to the State Construction Office.
f. Make documentation showing evidence of implementation of Designer's responsibilities available for review by State Construction Office and HUB Office, upon request.

5. Prime Contractor(s), CM at Risk, and Its First-Tier Subcontractors
Under the single-prime bidding, the separate-prime biding, construction manager at risk and alternative contracting methods, contractor(s) will:

a. Attend the scheduled prebid conference.
b. Identify or determine those work areas of a subcontract where minority businesses may have an interest in performing subcontract work.
c. At least ten (10) days prior to the scheduled day of bid opening, notify minority businesses of potential subcontracting opportunities listed in the proposal. The notification will include the following:
   (1) A description of the work for which the subbid is being solicited.
   (2) The date, time and location where subbids are to be submitted.
   (3) The name of the individual within the company who will be available to answer questions about the project.
   (4) Where bid documents may be reviewed.
   (5) Any special requirements that may exist, such as insurance, licenses, bonds and financial arrangements.

   If there are more than three (3) minority businesses in the general locality of the project who offer similar contracting or subcontracting services in the specific trade, the contractor(s) shall notify three (3), but may contact more, if the contractor(s) so desires.
d. During the bidding process, comply with the contractor(s) requirements listed in the proposal for minority participation.
e. Identify on the bid, the minority businesses that will be utilized on the project with corresponding total dollar value of the bid and affidavit listing good faith efforts as required by G.S. 143-128.2(c) and G.S. 143-128.2(f).
f. Make documentation showing evidence of implementation of PM, CM-at-Risk and First-Tier Subcontractor responsibilities available for review by State Construction Office and HUB Office, upon request.
g. Upon being named the apparent low bidder, the Bidder shall provide one of the following: (1) an affidavit (Affidavit C) that includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, which is equal to or more than the applicable goal; (2) if the percentage is not equal to the applicable goal, then documentation of all good faith efforts taken to meet the goal. Failure to comply with these requirements is grounds for rejection of the bid and award to the next lowest responsible and responsive bidder.
h. The contractor(s) shall identify the name(s) of minority business subcontractor(s) and corresponding dollar amount of work on the schedule of values. The schedule of values shall be provided as required in Article 31 of the General Conditions of the Contract to facilitate payments to the subcontractors.
i. The contractor(s) shall submit with each monthly pay request(s) and final payment(s), "MBE Documentation for Contract Payment" – (Appendix E), for designer's review.
j. During the construction of a project, at any time, if it becomes necessary to replace a minority business subcontractor, immediately advise the owner, State Construction Office, and the Director of the HUB Office in writing, of the circumstances involved. The prime contractor shall make a good faith effort to replace a minority business subcontractor with another minority business subcontractor.

k. If during the construction of a project additional subcontracting opportunities become available, make a good faith effort to solicit subbids from minority businesses.
l. It is the intent of these requirements apply to all contractors performing as prime contractor and first tier subcontractor under construction manager at risk on state projects.

6. Minority Business Responsibilities
While minority businesses are not required to become certified in order to participate in the State construction projects, it is recommended that they become certified and should take advantage of the appropriate technical assistance that is made available. In addition, minority businesses who are contacted by owners or bidders must respond promptly whether or not they wish to submit a bid.

SECTION 4: DISPUTE PROCEDURES
It is the policy of this state that disputes that involves a person's rights, duties or privileges, should be settled through informal procedures. To that end, minority business disputes arising under these guidelines should be resolved as governed under G.S. 143-128(g).

SECTION 5: These guidelines shall apply upon promulgation on state construction projects. Copies of these guidelines may be obtained from the Department of Administration, State Construction Office, (physical address) 301 North Wilmington Street, Suite 450, NC Education Building, Raleigh, North Carolina, 27601-2827, (mail address) 1307 Mail Service Center, Raleigh, North Carolina, 27699-1307, phone (919) 807-4100, Website: www.nc-sco.com

SECTION 6: In addition to these guidelines, there will be issued with each construction bid package provisions for contractual compliance providing minority business participation in the state construction program.

MINORITY BUSINESS CONTRACT PROVISIONS (CONSTRUCTION)

APPLICATION:

The **Guidelines for Recruitment and Selection of Minority Businesses for Participation in State Construction Contracts** are hereby made a part of these contract documents. These guidelines shall apply to all contractors regardless of ownership. Copies of these guidelines may be obtained from the Department of Administration, State Construction Office, (physical address) 301 North Wilmington Street, Suite 450, NC Education Building, Raleigh, North Carolina, 27601-2827, (mail address) 1307 Mail Service Center, Raleigh, North Carolina, 27699-1307, phone (919) 807-4100, Website: http://www.nc-sco.com

MINORITY BUSINESS SUBCONTRACT GOALS:

The goals for participation by minority firms as subcontractors on this project have been set at 10%.

The bidder must identify on its bid, the minority businesses that will be utilized on the project with corresponding total dollar value of the bid and affidavit (Affidavit A) listing good faith efforts **or** affidavit (Affidavit B) of self-performance of work, if the bidder will perform work under contract by its own workforce, as required by G.S. 143-128.2(c) and G.S. 143-128.2(f).

The lowest responsible, responsive bidder must provide Affidavit C, that includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, which is equal to or more than the applicable goal.

OR

Provide Affidavit D, that includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, **with documentation of Good Faith Effort, if the percentage is not equal to the applicable goal.**

OR

Provide Affidavit B, which includes sufficient information for the State to determine that the bidder does not customarily subcontract work on this type project.

The above information must be provided as required. Failure to submit these documents is grounds for rejection of the bid.

MINIMUM COMPLIANCE REQUIREMENTS:

All written statements, affidavits or intentions made by the Bidder shall become a part of the agreement between the Contractor and the State for performance of this contract. Failure to comply with any of these statements, affidavits or intentions, or with the minority business Guidelines shall constitute a breach of the contract. A finding by the State that any information submitted either prior to award of the contract or during the performance of the contract is inaccurate, false or incomplete, shall also constitute a breach of the contract. Any such breach may result in termination of the contract in accordance with the termination provisions contained in the contract. It shall be solely at the option of the State whether to terminate the contract for breach.

In determining whether a contractor has made Good Faith Efforts, the State will evaluate all efforts made by the Contractor and will determine compliance in regard to quantity, intensity, and results of these efforts. Good Faith Efforts include:

(1) Contacting minority businesses that reasonably could have been expected to submit a quote and that were known to the contractor or available on State or local government maintained lists at least 10 days before the bid or proposal date and notifying them of the nature and scope of the work to be performed.

(2) Making the construction plans, specifications and requirements available for review by prospective minority businesses, or providing these documents to them at least 10 days before the bid or proposals are due.

(3) Breaking down or combining elements of work into economically feasible units to facilitate minority participation.

(4) Working with minority trade, community, or contractor organizations identified by the Office for Historically Underutilized Businesses and included in the bid documents that provide assistance in recruitment of minority businesses.

(5) Attending any prebid meetings scheduled by the public owner.

(6) Providing assistance in getting required bonding or insurance or providing alternatives to bonding or insurance for subcontractors.

(7) Negotiating in good faith with interested minority businesses and not rejecting them as unqualified without sound reasons based on their capabilities. Any rejection of a minority business based on lack of qualification should have the reasons documented in writing.

(8) Providing assistance to an otherwise qualified minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letters of credit, including waiving credit that is ordinarily required. Assisting minority businesses in obtaining the same unit pricing with the bidder's suppliers in order to help minority businesses in establishing credit.

(9) Negotiating joint venture and partnership arrangements with minority businesses in order to increase opportunities for minority business participation on a public construction or repair project when possible.

(10) Providing quick pay agreements and policies to enable minority contractors and suppliers to meet cash-flow demands.

APPENDIX E

MBE DOCUMENTATION FOR CONTRACT PAYMENTS

Prime Contractor/Architect: _____

Address & Phone: _____

Project Name: _____

Pay Application #: _____ Period: _____

The following is a list of payments made to Minority Business Enterprises on this project for the above-mentioned period.

MBE FIRM NAME	* INDICATE TYPE OF MBE	AMOUNT PAID THIS MONTH	TOTAL PAYMENTS TO DATE	TOTAL AMOUNT COMMITTED

*Minority categories: Black, African American (B), Hispanic (H), Asian American (A), American Indian (I), Female (F), Social and Economically Disadvantage (D)

Date: _____ Approved/Certified By: _____
Name

_____
Title

_____
Signature

SUBMIT WITH EACH PAY REQUEST & FINAL PAYMENT

(Revised on 3/14/2003)

Identification of Minority Business Participation

I,_____
(Name of Bidder)

do hereby certify that on this project, we will use the following minority business enterprises as construction subcontractors, vendors, suppliers or providers of professional services.

Firm Name, Address and Phone #	Work type	*Minority Category

*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

The total value of minority business contracting will be ($)_____.

MBForms 2002-Revised
March, 2005

State of North Carolina AFFIDAVIT A – Listing of Good Faith Efforts

County of _____

(Name of Bidder)

Affidavit of_____

I have made a good faith effort to comply under the following areas checked:

Bidders must earn at least 50 points from the good faith efforts listed for their bid to be considered responsive. (1 NC Administrative Code 30 I.0101)

- ☐ **1 – (10 pts)** Contacted minority businesses that reasonably could have been expected to submit a quote and that were known to the contractor, or available on State or local government maintained lists, at least 10 days before the bid date and notified them of the nature and scope of the work to be performed.
- ☐ **2 –(10 pts)** Made the construction plans, specifications and requirements available for review by prospective minority businesses, or providing these documents to them at least 10 days before the bids are due.
- ☐ **3 – (15 pts)** Broken down or combined elements of work into economically feasible units to facilitate minority participation.
- ☐ **4 – (10 pts)** Worked with minority trade, community, or contractor organizations identified by the Office of Historically Underutilized Businesses and included in the bid documents that provide assistance in recruitment of minority businesses.
- ☐ **5 – (10 pts)** Attended prebid meetings scheduled by the public owner.
- ☐ **6 – (20 pts)** Provided assistance in getting required bonding or insurance or provided alternatives to bonding or insurance for subcontractors.
- ☐ **7 – (15 pts)** Negotiated in good faith with interested minority businesses and did not reject them as unqualified without sound reasons based on their capabilities. Any rejection of a minority business based on lack of qualification should have the reasons documented in writing.
- ☐ **8 – (25 pts)** Provided assistance to an otherwise qualified minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letters of credit, including waiving credit that is ordinarily required. Assisted minority businesses in obtaining the same unit pricing with the bidder's suppliers in order to help minority businesses in establishing credit.
- ☐ **9 – (20 pts)** Negotiated joint venture and partnership arrangements with minority businesses in order to increase opportunities for minority business participation on a public construction or repair project when possible.
- ☐ **10 - (20 pts)** Provided quick pay agreements and policies to enable minority contractors and suppliers to meet cash-flow demands.

The undersigned, if apparent low bidder, will enter into a formal agreement with the firms listed in the Identification of Minority Business Participation schedule conditional upon scope of contract to be executed with the Owner. Substitution of contractors must be in accordance with GS143-128.2(d) Failure to abide by this statutory provision will constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of the minority business commitment and is authorized to bind the bidder to the commitment herein set forth.

Date:_____ Name of Authorized Officer:_____

Signature:_____

Title:_____

SEAL

State of_____, County of_____

Subscribed and sworn to before me this _____day of _____20____

Notary Public_____

My commission expires _____

MBForms 2002-Revised
March, 2005

State of North Carolina --AFFIDAVIT B-- Intent to Perform Contract with Own Workforce.

County of _____

Affidavit of _____
(Name of Bidder)

I hereby certify that it is our intent to perform 100% of the work required for the _____

_____ contract.
(Name of Project)

In making this certification, the Bidder states that the Bidder does not customarily subcontract elements of this type project, and normally performs and has the capability to perform and will perform all elements of the work on this project with his/her own current work forces; and

The Bidder agrees to provide any additional information or documentation requested by the owner in support of the above statement.

The undersigned hereby certifies that he or she has read this certification and is authorized to bind the Bidder to the commitments herein contained.

Date: _____ Name of Authorized Officer: _____

Signature: _____

Title: _____

SEAL

State of _____, County of _____

Subscribed and sworn to before me this _____ day of _____ 20___

Notary Public _____

My commission expires _____

Do not submit with bid Do not submit with bid Do not submit with bid Do not submit with bid

State of North Carolina - AFFIDAVIT C - Portion of the Work to be Performed by Minority Firms

County of _____

(Note this form is to be submitted only by the apparent lowest responsible, responsive bidder.)

If the portion of the work to be executed by minority businesses as defined in GS143-128.2(g) is equal to or greater than 10% of the bidders total contract price, then the bidder must complete this affidavit. This affidavit shall be provided by the apparent lowest responsible, responsive bidder within **72 hours** after notification of being low bidder.

Affidavit of _____ I do hereby certify that on the
(Name of Bidder)

_____
(Project Name)

Project ID#_____ Amount of Bid $_____

I will expend a minimum of _____% of the total dollar amount of the contract with minority business enterprises. Minority businesses will be employed as construction subcontractors, vendors, suppliers or providers of professional services. Such work will be subcontracted to the following firms listed below. Attach additional sheets if required

Name and Phone Number	*Minority Category	Work description	Dollar Value

*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

Pursuant to GS143-128.2(d), the undersigned will enter into a formal agreement with Minority Firms for work listed in this schedule conditional upon execution of a contract with the Owner. Failure to fulfill this commitment may constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the bidder to the commitment herein set forth.

Date:_____ Name of Authorized Officer:_____

Signature:_____

SEAL

Title:_____

State of _____, County of _____

Subscribed and sworn to before me this _____ day of _____ 20____

Notary Public_____

My commission expires_____

MBForms 2002-Revised
March, 2005

State of North Carolina AFFIDAVIT D – Good Faith Efforts

County of _____.

(Note this form is to be submitted only by the apparent lowest responsible, responsive bidder.)

If the goal of 10% participation by minority business **is not** achieved, the Bidder shall provide the following documentation to the Owner of his good faith efforts:

Affidavit of _____ I do hereby certify that on the
(Name of Bidder)

_____
(Project Name)

Project ID#_____ Amount of Bid $_____

I will expend a minimum of _____% of the total dollar amount of the contract with minority business enterprises. Minority businesses will be employed as construction subcontractors, vendors, suppliers or providers of professional services. Such work will be subcontracted to the following firms listed below. (Attach additional sheets if required)

Name and Phone Number	*Minority Category	Work description	Dollar Value

*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

Examples of documentation that may be required to demonstrate the Bidder's good faith efforts to meet the goals set forth in these provisions include, but are not necessarily limited to, the following:

A. Copies of solicitations for quotes to at least three (3) minority business firms from the source list provided by the State for each subcontract to be let under this contract (if 3 or more firms are shown on the source list). Each solicitation shall contain a specific description of the work to be subcontracted, location where bid documents can be reviewed, representative of the Prime Bidder to contact, and location, date and time when quotes must be received.

B. Copies of quotes or responses received from each firm responding to the solicitation.

C. A telephone log of follow-up calls to each firm sent a solicitation.

D. For subcontracts where a minority business firm is not considered the lowest responsible sub-bidder, copies of quotes received from all firms submitting quotes for that particular subcontract.

E. Documentation of any contacts or correspondence to minority business, community, or contractor organizations in an attempt to meet the goal.

F. Copy of pre-bid roster.

G. Letter documenting efforts to provide assistance in obtaining required bonding or insurance for minority business.

H. Letter detailing reasons for rejection of minority business due to lack of qualification.

I. Letter documenting proposed assistance offered to minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letter of credit, including waiving credit that is ordinarily required.

Failure to provide the documentation as listed in these provisions may result in rejection of the bid and award to the next lowest responsible and responsive bidder.

Pursuant to GS143-128.2(d), the undersigned will enter into a formal agreement with Minority Firms for work listed in this schedule conditional upon execution of a contract with the Owner. Failure to fulfill this commitment may constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the bidder to the commitment herein set forth.

Date:_____ Name of Authorized Officer:_____

Signature:_____

Title:_____

SEAL

State of_____, County of _____

Subscribed and sworn to before me this _____day of _____20____

Notary Public_____

My commission expires _____

SECTION 00410

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we,

_____,
(Bidder's Name)

_____, of _____
(Street Address) (City, State, Zip)

hereinafter called the Principal, and

_____ of
(Surety's Name)

_____, a Corporation duly organized, and existing under the laws of the State of _____ and authorized to transact business in the State of North Carolina, as Surety, hereinafter called the Surety, are held and firmly bound unto the County of Cabarrus as Owner, hereinafter called the Obligee, in the Penal sum of five percent (5%)of the amount bid, good and lawful money of the United States of America, for the payment for which the Principal and the Surety, bind ourselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents. This bid bond is submitted in lieu of submitting cash, a cashier's check, or a certified check pursuant to G.S. 143- 129.

WHEREAS, the Principal has submitted a Bid for the construction of _____
(Project Name)

Cabarrus County Construction and Demolition Debris Landfill Phase 1L Expansion

NOW THEREFORE, if the Obligee shall accept the Bid of the Principal and the Principal shall enter into a Contract with the Obligee in accordance with the terms of said Bid, and give such bond or bonds as may be specified in the Bidding and Contract Documents with good and sufficient surety for the faithful performance of such Contract and for the prompt payment of labor and materials furnished in the prosecution thereof, or in the event of the failure of the Principal to enter into such Contract and give such bond or bonds the Surety shall, upon demand forthwith pay to the Obligee the amount set forth above. The Principal shall pay the Obligee the difference not to exceed the penalty hereof between the amount specified in said Bid and such larger amount for which the Obligee may in good faith contract with another party to perform the work covered by said Bid, then this obligation shall be null and void, otherwise to remain in full force and effect.

SIGNED AND SEALED this ____ day of _____, 20___ in the presence of:

Witness _____ Witness _____

_____ (SEAL) _____ (SEAL)
Principal Surety

_____ _____
Title Title

SECTION 00420

CONTRACTOR'S QUALIFICATION FORM FOR THE GENERAL CONTRACTOR

Cabarrus County C&D Landfill
Phase 1L Expansion
Cabarrus County, North Carolina

Completion of this Qualification Form by a firm is not intended, nor does it operate, to guarantee or warrant that the firm will be selected for any actual work to be let for this project. Firms are advised that they still will be required to meet and comply with the Specifications of this Project and all requirements of the Contract Documents to qualify for this Project. **This Qnalification Form must be submitted along with Contractor's bid package.**

The undersigned certifies under oath that the information provided herein is true and sufficiently complete so as to not be misleading.

Submitted by:

Name of Organization__

Name of Individual____

Title_____

Address_____

_____

Telephone_____

1.0 GENERAL INFORMATION

☐ Corporation ☐ Partnership ☐ Joint Venture ☐ Sole Proprietorship

If Corporation:

a. Date and State of Incorporation

_____

_____

b. List of Executive Officers:

Name Title

_____

_____

_____

_____

If Partnership:

a. Date and State of Organization

_____

_____

Type of Partnership

☐ General ☐ Publicly Traded

☐ Limited ☐ Other (describe):_____

b. Names, Addresses and Form of Organization of General Partners:

_____

_____

_____

_____

_____

_____

_____

If Joint Venture:

a. Date and State of Organization

_____

_____

b. Names, Addresses and Form of Organization of Joint Venture Partners: (Indicate managing partner by an asterisk)

_____

_____

_____

_____

_____

If Sole Proprietorship:

a Date and State of Organization

_____

_____

b. Name and Address of Owner(s)

_____

_____

_____

_____

_____

1.3 Has your Organization or any of your Subsidiaries ever been convicted of a bidding violation?

_____ YES _____ NO

If yes, details must be provided on a separate sheet.

2.0 LICENSE

2.1 Provide the information for the categories your organization has a North Carolina Contractor's License.

	Contractor's License Number	Expiration Date
Grading & Excavation:	_____	_____

	Contractor's	Expiration

	License Number	Date
Highways:	_____	_____
Unclassified:	_____	_____

3.0 EXPERIENCE

3.1 Complete Attachment "A" for each ***landfill*** project contracted by your organization for the past five years. For your qualification form to be considered, the list must include a minimum of three Subtitle D landfill and/or lined C&D landfill projects which (1) your organization was contractually and financially responsible directly to the Owner/Client for completing, (2) was completed by your organization's supervision, direction and control, and (3) had a minimum of 300,000 square feet of geosynthetic liner system consisting of) (a) a 40 mil HDPE liner, (b) geocomposite drainage net and (c) a two foot thick protective cover layer. Projects should also include the installation of a leachate collection system including piping and pumps. **If the Contractor intends to subcontract out any portion of the composite liner system installation, the Contractor shall indicate so, and submit (with this Section) evidence that the subcontractor meets the same experience requirements.**

3.2 Complete Attachment "B" for each construction project which exceeds $ 2,000,000 that your organization has in progress.

3.3 State total dollar amount of work in progress and under contract.

3.4 State annual amount of construction work performed during the past five years.

Year	$ Amount
2005	$_____
2006	$_____
2007	$_____
2008	$_____
2009	$_____

4.0 Claims and Suits (If the answer to any questions below is yes, please attach details

4.1 Has your Organization ever failed to complete any work awarded to it?

4.2 Are there any judgments, claims, arbitration proceedings or suits pending or outstanding against your organization or its officers?

4.3 Has your organization filed any lawsuits or requested arbitration with regard to construction contracts within the last five years?

5.0 FINANCIAL INFORMATION

5.1 The successful Bidder shall submit to the Owner, within 2 days of written request by the Owner, audited financial statement, including your organization's latest balance sheet, income statement, cash flow statement, and all financial statement notes showing the following items:

Current Assets; (e.g. cash, joint venture accounts, accounts receivable, notes receivable, accrued income, deposits, material inventory and prepaid expenses);

Net Fixed Assets;

Other Assets

Current Liabilities e.g., accounts payable, notes payable, accrued expenses, provision for income taxes, advances accrued salaries and accrued payroll taxes);

Other liabilities (e.g., capital, capital stock, authorized and outstanding shares par values, earned surplus and retained earnings).

5.2 Provide the following information with respect to an accredited banking institution familiar with your organization:

Name of Bank: _____

Account Manager _____

Address: _____

_____

Telephone: _____

Name of Bank: _____

Account Manager _____

Address: _____

_____

Telephone: _____

5.3 Provide a certified copy of your organization's current Dunn & Bradstreet rating:

5.4 Provide the following for your bonding company:

Company Name: _____

Telephone Number: _____

Contact Person: _____

Bond Company Rating: _____

Provide a letter from your bonding company stating that your organization can obtain a performance bond for this project equal to the total bid amount (Base Bid Amount plus all Alternates).

5.6 Is your Organization now or has it ever been involved in bankruptcy or reorganization proceedings?

_____ YES _____ NO

If yes, details must be provided on a separate sheet

6.0 SAFETY

6.1 List your Organization's Insurance Interstate Experience Modification Rate (EMR) for the three most recent years:

	2007	2008	2009
For the entire Organization	_____	_____	_____
For your particular entity or division of the Organization	_____	_____	_____

Provide certified copies of the EMR report.

I hereby certify that the information submitted herewith, including any attachment, is true to the best of my knowledge and belief.

_____

By: _____

Title: _____

Dated: _____

ATTACHMENT "A"
COMPLETE A SEPARATE FORM FOR EACH PROJECT

4.2.1 Project Background

Project Name _____

Project Purpose _____

Organization's Project Manager _____

Your Organization's Full time on-site Supervisor _____

Project Location _____

Bonding Company _____

4.2.2 Project Schedule

Notice to Proceed Date ____/____/____

Contracted Substantial Completion Date ____/____/____

Actual Substantial Completion Date ____/____/____

Date of Final Payment ____/____/____

4.2.3 Project Cost

Original Contract Price $_____

Number of Change Orders _____

Change Order Amount $_____

*Final Contract Price $_____

*If final contract amount varies by more than 10% compared to the original contract amount, provide details on a separate sheet.

4.2.4 Contacts Who are Familiar With Project Details

Client/Owner Name ___

Client/Owner Telephone _____

Design/Certifying Engineer Name _____

Design/Certifying Engineer Telephone _____

4.2.5 Landfill Components

	Square Feet Installed	Subcontracted*
	Yes / No	
40 mil HDPE Liner	_____	Yes / No
Geocomposite Drainage Net leachate collection/ protective cover layer	_____	Yes / No

*Circle "Yes" if you had others perform the work for you as subcontractors. Circle "No" if the work was performed with Organization forces.

ATTACHMENT "B"

Name of Project	Owner/Client	Designer/Engineer	Contract Amount	Percent Complete	Scheduled Completion Date
_____	_____	_____			
_____	_____	_____			
_____	_____	_____	$_____	_____%	___/___/___
_____	_____	_____			
_____	_____	_____			
_____	_____	_____	$_____	_____%	___/___/___
_____	_____	_____			
_____	_____	_____			
_____	_____	_____	$_____	_____%	___/___/___
_____	_____	_____			
_____	_____	_____			
_____	_____	_____	$_____	_____%	___/___/___

SECTION 00421

QUALIFICATION FORM FOR THE THERMOSET POWDER EPOXY COATED STEEL BOLTED LEACHATE STORAGE TANK SUBCONTRACTOR

Cabarrus County C&D Landfill
Phase 1L Expansion
Cabarrus County, North Carolina

Completion of this Qualification Form by a firm is not intended, nor does it operate, to guarantee or warrant that the firm will be selected for any actual work to be let for this project. Firms are advised that they still will be required to meet and comply with the Specifications of this Project and all requirements of the Contract Documents to qualify for this Project. **This Qualification Form must be submitted along with Contractor's bid package.**

The undersigned certifies under oath that the information provided herein is true and sufficiently complete so as to not be misleading.

Submitted by:

Name of the Tank Manufacturing Organization (Subcontractor)_____

Name of Individual_____

Title_____

Address_____

Telephone_____

1.0 GENERAL INFORMATION

☐ Corporation ☐ Partnership ☐ Joint Venture ☐ Sole Proprietorship

If Corporation:

a. Date and State of Incorporation

_____

b. List of Executive Officers:

Name	Title
_____	
_____	
_____	

If Partnership:

a. Date and State of Organization

Type of Partnership

☐ General ☐ Publicly Traded

☐ Limited ☐ Other (describe):

b. Names, Addresses and Form of Organization of General Partners:

If Joint Venture:

a. Date and State of Organization

b. Names, Addresses and Form of Organization of Joint Venture Partners: (Indicate managing partner by an asterisk)

If Sole Proprietorship:

a Date and State of Organization

b. Name and Address of Owner(s)

Has your Organization or any of your Subsidiaries ever been convicted of a bidding or contract term violation?

_____ YES _____ NO

If yes, details must be provided on a separate sheet.

2.0 EXPERIENCE

2.1 Complete Attachment "A" for each thermoset powder epoxy coated bolted steel tank that was constructed for the storage of landfill leachate or wastewater similar in corrosiveness and aggressiveness of leachate. Provide tank projects that were manufactured and installed by your organization for the past five years. For your qualification form to be considered, the list must include a minimum of ten thermoset powder epoxy coated bolted tanks out of which a least two were installed for sole purpose of landfill leachate storage which (1) your organization has manufactured (2) was installed by your organization's supervision, direction and control, and (3) had a minimum of 150,000 gallons in nominal capacity. A minimum of five of the tank projects must have been in service, to the satisfaction of the owner, for at least 5 years.

2.2 Complete Attachment "B" for each tank manufacturing and erection project which exceeds $ 500,000 that your organization has in progress.

2.3 State total dollar amount of work in progress and under contract.

2.4 State annual amount of work performed during the past five years.

Year	$ Amount
2005	$_____
2006	$_____
2007	$_____
2008	$_____
2009	$_____

3.0 CLAIMS AND SUITS (If the answer to any questions below is yes, please attach details

3.1 Has your Organization ever failed to complete any work awarded to it?

3.2 Are there any judgments, claims, arbitration proceedings or suits pending or outstanding against your organization or its officers?

3.3 Has your organization filed any lawsuits or requested arbitration with regard to construction contracts within the last five years?

4.0 FINANCIAL INFORMATION

4.1 The tank Subcontractor proposed by the successful Bidder shall submit to the Owner, within 2 days of written request by the Owner, audited financial statement, including the organization's latest balance sheet, income statement, cash flow statement, and all financial statement notes showing the following items:

Current Assets; (e.g. cash, joint venture accounts, accounts receivable, notes receivable, accrued income, deposits, material inventory and prepaid expenses);

Net Fixed Assets;

Other Assets

Current Liabilities e.g., accounts payable, notes payable, accrued expenses, provision for income taxes, advances accrued salaries and accrued payroll taxes);

Other liabilities (e.g., capital, capital stock, authorized and outstanding shares par values, earned surplus and retained earnings).

4.2 Provide the following information with respect to an accredited banking institution familiar with your organization:

Name of Bank: _____

Account Manager _____

Address: _____

_____

Telephone: _____

Name of Bank: _____

Account Manager _____

Address: _____

_____

Telephone: _____

4.3 Provide a certified copy of your organization's current Dunn & Bradstreet rating:

4.4 Is your Organization now or has it ever been involved in bankruptcy or reorganization proceedings?

_____ YES _____ NO

If yes, details must be provided on a separate sheet

5.0 SAFETY

5.1 List your Organization's Insurance Interstate Experience Modification Rate (EMR) for the three most recent years:

	2007	2008	2009
For the entire Organization	_____	_____	_____
For your particular entity or division of the Organization	_____	_____	_____

Provide certified copies of the EMR report.

6.0 DESIGN AND CERTIFICATION

6.1 Name of the Professional Engineer who has designed (or will design) and certify the foundation:

_____

License Number and State: _____

6.2 I hereby certify that the information submitted herewith, including any attachment, is true to the best of my knowledge and belief. I also certify that the proposed tank and coating are designed to perform in the application of C&D landfill leachate storage based on the data provided in the Specifications or made available to me separately by the Engineer or the Owner.

By: _____

Title: _____

Dated: _____

ATTACHMENT "A"
COMPLETE A SEPARATE FORM FOR EACH PROJECT

6.1 Project Background

Project Name _____

Project Purpose _____

Project Location _____

_____

Your Organization's Full time on-site Supervisor _____

6.2 Project Schedule

Date Project Started ____/____/____

Scheduled Substantial Completion Date ____/____/____

Actual Substantial Completion Date ____/____/____

Date of Final Release to Owner ____/____/____

6.3 Project Cost

Original Contract Price $_____

Number of Change Orders (Related to the tank work) _____

Change Order Amount $_____

*Final Contract Price $_____

*If final contract amount varies by more than 10% compared to the original contract amount, provide details on a separate sheet.

6.4 Contacts who are Familiar with Project Details

Client/Owner Name _____

Client/Owner Telephone _____

Design/Certifying Engineer Name _____

Design/Certifying Engineer Telephone _____

General Contractor (if Applicable) Name and Contact_____

_____

6.5 Tank Details

Tank Volume _____ gallons

What Liquid will be contained in the Tank _____

Coating Product Name, Manufacturer and Thickness_____

_____

_____

Was the tank foundation designed by your organization?

If No, provide name of other firms involved with the foundation design? _____

_____

Was the tank foundation constructed by your organization?

If No, provide name of other firms involved with the foundation construction? _____

_____

Was the tank piping and accessories (flow meters, pumps, level switch, pump controls etc…) , installed by your organization?

If No, provide the name of other firms involved with the tank piping and accessories? _____

_____

6.6 Warranty and Claims

What was the warranty provided for the tank project? _____ years

Have there been any claims or complaints within the warranty period?

Have there been any claims or complaints beyond the warranty period?

If you answered yes to any of the above, please provide explanation including date of the claims, reason, and outcome.

_____

_____

_____

_____

ATTACHMENT "B"

Name of Project	Owner/Client	Designer/Engineer	Contract Amount	Percent Complete	Scheduled Completion Date
_____	_____	_____			
_____	_____	_____			
_____	_____	_____	$_____	_____%	___/___/___
_____	_____	_____			
_____	_____	_____			
_____	_____	_____	$_____	_____%	___/___/___
_____	_____	_____			
_____	_____	_____			
_____	_____	_____	$_____	_____%	___/___/___
_____	_____	_____			
_____	_____	_____			
_____	_____	_____	$_____	_____%	___/___/___

SECTION 00480

NON-COLLUSIVE AFFIDAVIT
(Submit with bid documents)

State of_____)

County of _____)

_____ being first duly sworn, deposes and says that:

(1) He/She is the _____, (Owner, Partner, Officer, Representative or Agent) of _____ the Bidder that has submitted the attached Bid;

(2) He/She is fully informed respecting the preparation and contents of the attached Bid and of all pertinent circumstances respecting such Bid;

(3) Such Bid is genuine and is not a collusive or sham Bid;

(4) Neither the said Bidder nor any of its officers, partners, owners, agents, representatives, employees or parties in interest, including this affiant, have in any way colluded, conspired, connived or agreed, directly or indirectly, with any other Bidder, firm, or person to submit a collusive or sham Bid in connection with the Work for which the attached Bid has been submitted; or to refrain from bidding in connection with such Work; or have in any manner, directly or indirectly, sought by agreement or collusion, or communication, or conference with any Bidder, firm, or person to fix the price or prices in the attached Bid or of any other Bidder, or to fix any overhead, profit, or cost elements of the Bid price or the Bid price of any other Bidder, or to secure through any collusion, conspiracy, connivance, or unlawful agreement any advantage against (Recipient), or any person interested in the proposed Work;

(5) The price or prices quoted in the attached Bid are fair and proper and are not tainted by any collusion, conspiracy, connivance, or unlawful agreement on the part of the Bidder or any other of its agents, representatives, owners, employees or parties in interest, including this affidavit.

BY_____

ITS_____
(Title)

Subscribed and sworn to before me

this _____ day of _____, 200___.

_____

_____

My commission expires _____

END OF SECTION

SECTION 00485

AUTHORITY TO EXECUTE CONTRACT

If the Bidder is a Corporation, attach to this page a certified copy of corporate resolutions of the Board of Directors of the Corporation authorizing an officer of the Corporation to execute the Agreement contained within this document on behalf of the Corporation.

END OF SECTION

SECTION 00500

CONSTRUCTION AGREEMENT
FORM

CABARRUS COUNTY
CONSTRUCTION AND DEMOLITION LANDFILL
PHASE 1 EXPANSION PROJECT

THIS AGREEMENT, made as of the ___ day of _____, 20___, by and between _____, a corporation, hereinafter called the Contractor, and Cabarrus County, a body corporate and politic and a political subdivision of the State of North Carolina, hereinafter called the Owner.

W I T N E S S E T H:

That the Contractor and the Owner, for the consideration herein named, agree as follows:

1. SCOPE OF WORK - The Contractor shall furnish and deliver all of the materials, and perform all of the work required by this Agreement and the following enumerated documents, which are attached hereto and made a part hereof as if fully contained herein: General Conditions, Supplemental Conditions, Contract Construction Schedule, Specifications, Drawings entitled "Construction and Demolition Debris Landfill Phase 1L Expansion Project" dated September 2010, which Drawings are listed in the Specifications, Performance Bond, Labor and Material Payment Bond, Insurance Certificates, and the following addenda:

All of the documents listed, referenced or described in this paragraph, together with Modifications made or issued in accordance herewith are the Contract Documents, and the work, labor, materials and completed construction required by the Contract Documents and all parts thereof is the Work. The Contractor shall perform the Work in the time, manner and form required by the Contract Documents. The Contract Documents constitute the entire agreement between Owner and Contractor.

The Work to be performed under this Contract generally includes the construction of a 2.1 acre double-lined cell area. Work is to include the installation of a 40-mil HDPE base liner, geocomposite drainage net, a 10-inch secondary soil drainage layer and 24-inch protective soil drainage layer. Protective cover and secondary drainage layer material shall be obtained from an offsite borrow source with a specified permeability of 5×10^{-5} cm/sec or greater (more permeable). Work shall include stripping existing vegetation, preparing the liner subgrade and liner installation, as well as a leachate collection system with force main, erosion control measures, seeding and mulching and other incidentals as shown on the Drawings and as noted in the Specifications. In addition, work will also include the construction of a leachate tank truck loading area. A 150,000 gallon leachate storage tank system (including secondary containment, piping, transfer pump, etc.) shall be included as a bid alternate. The Owner's onsite borrow area will be available for liner subgrade preparation and miscellaneous soil needs. Sorting and processing

of the onsite borrow soil may be needed. Work may also include the construction of a Subcell A area within the lined expansion. This will depend on the need for permitted airspace for waste disposal prior to overall project completion. Days will be added to the date of Substantial Completion if this option is selected.

2. The Contractor agrees to commence work not later than three (3) days after the commencement date specified in the Notice to Proceed. The Contractor agrees to complete fully all Work hereunder on the dates specified below in Paragraph 3 – Contract Time, as may be adjusted in accordance with the terms of the Contract Documents. Time is of the essence with respect to all dates specified in the Contract Documents as Completion Dates. Liquidated damages for failure(s) to complete in accordance with the provisions of this paragraph shall be computed and assessed against the Contractor in accordance with Paragraph 13.18 of the Supplementary General Conditions (Section 00800).

3. Contract Time

In order to ensure that the Owner has permitted landfill disposal space prior to the end of **May, 2011**, a phased approach to construction of the Phase 1L expansion may be required depending upon the impact of construction weather days and actual waste tonnages being received at the landfill.

A 1-acre area adjacent to the existing C&D landfill has been identified as Subcell A of the Phase 1L landfill construction. Substantial Completion of the Subcell A area will include all work necessary to provide the Owner with permitted waste disposal capacity including, but not limited to the full double liner system, leachate collection and header piping, leachate force main piping, sumps, pumps, work in support of the leachate storage tank (or leachate storage tank facility complete if alternate is accepted), and all testing and CQA data.

Substantial Completion for the entire landfill expansion is **150 calendar days** from Notice to Proceed (NTP). The Owner and Engineer will work closely with the Contractor to determine if the entire landfill expansion can be completed within the 150 days and permitted airspace provided, or if the phased approach will need to be implemented. In order to provide the Contractor with ample notice regarding the implementation of a phased approach, the Owner will decide within **45 calendar days** of NTP whether or not to implement the phased approach.

If the phased approach is implemented, Contractor shall have Subcell A substantially complete within **120 calendar days** of NTP. The remaining work shall be substantially complete within **150 calendar days**.

All work shall reach final completion within **180 calendar days** from Notice to Proceed.

4. The Owner hereby agrees to pay to the Contractor for the faithful performance of this Agreement, and the Contractor hereby agrees to perform all of the Work, for the sum of _____ Dollars ($_____) in the lawful money of the United States, subject to adjustments as provided for in the Contract Documents. Payment of the Contract Price shall be in accordance with Articles 20 and 21 of the General Conditions.

5. It is further mutually agreed between the parties hereto that if at any time after the execution of this Agreement and the Performance Bond and Labor and Material Payment Bond hereto attached for its faithful performance, the Owner shall deem the surety or sureties upon such Bonds to be unsatisfactory, or if, for any reason, such Bonds or either of them cease to be adequate to cover the performance of and payment for the Work, the Contractor shall, at its expense, within five (5) days after notice from the Owner so to do, furnish an additional bond or bonds in such form and amount and with such surety or sureties as shall be satisfactory to the Owner. In such event no further payment to the Contractor shall be

deemed to be due under this Agreement until such new or additional security for the faithful performance of or payment for the Work shall be furnished in a manner and form satisfactory to the Owner.

6. Terms used in this Agreement which are defined in the Contract Documents shall have the meanings designated in those Contract Documents.

7. The laws of the State of North Carolina shall apply to the interpretation and enforcement of this Agreement. Any and all suits or actions to enforce, interpret or seek damages with respect to any provision of, or the performance or nonperformance of, this Agreement shall be brought in the General Court of Justice of North Carolina sitting in Cabarrus County, North Carolina, and it is agreed by the parties that no other court shall have jurisdiction or venue with respect to such suits or actions.

IN WITNESS WHEREOF, the Parties hereto have executed this Agreement as of the day and date first above written in a number of counterparts, each of which shall, without proof or accounting for other counterparts, be deemed an original contract.

_____

Contractor: (Trade or Corporate Name)

By: _____

Title: _____
(President)

ATTEST: (CORPORATION)

By: _____

Title: _____
(Corporate Secretary)

(CORPORATE SEAL)

WITNESS:

_____
(Proprietorship or Partnership)

CABARRUS COUNTY
65 Church Street
P.O. Box 707
Concord, NC 28026

By: _____
H. Jay White, Sr.
Chair, Board of Commissioners

ATTEST: _____
Kay Honeycutt
Clerk to the Board

This instrument has been pre-audited in the manner required by the local Government Budget and Fiscal Control Act.

_____
Pam Dubois
Finance Director of Cabarrus County

This instrument is approved as to Form.

_____
Richard M. Koch
Cabarrus County Attorney

SECTION 00610

PAYMENT BOND

Date of Contract: _____

Date of Execution _____

Name of Principal (Contractor) _____

Name of Surety _____

Name of Contracting Body North Carolina
County of Cabarrus

Amount of Bond: _____ Dollars ($_____)

Project: Cabarrus County,
Construction and Demolition Debris Landfill Phase 1L Expansion Project

KNOW ALL MEN BY THESE PRESENTS, that we, the PRINCIPAL and SURETY above named, are held and firmly bound unto the above named owner, hereinafter called "Owner", in the penal sum of the amount stated above, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal entered into a certain Contract with the Owner identified as shown above and hereto attached:

NOW THEREFORE, if the Principal shall promptly make payment to all persons supplying labor and material in the prosecution of the Work provided for in said Contract, and any and all duly authorized modifications of said Contract that may hereafter be made, notice of which modification to the Surety being hereby waived, then this obligation to be void; otherwise to remain in full force and virtue.

IN WITNESS WHEREOF, the above-bounden parties have executed this instrument under their several seals on the date indicated above, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representatives, pursuant to authority of its governing body.

PAYMENT BOND

Executed in Four (4) Counterparts.

CONTRACTOR:

By:_____

Title:_____
(Corporation President or
Vice President Only)

ATTEST: (Corporation)

_____
(Corporation Secretary or Assistant
Secretary Only) (CORPORATE SEAL)

SURETY COMPANY:

WITNESS: By:_____

_____ Title:_____
(Attorney in Fact)

(SURETY CORPORATE SEAL)

COUNTERSIGNED:

_____

_____
(N.C. Licensed Resident Agent)

_____

_____
Name and Address-Surety Agency

_____

_____
Surety Company Name and N.C.
Regional or Branch Office Address

SECTION 00620

PERFORMANCE BOND

Date of Contract: _____

Date of Execution _____

Name of Principal (Contractor) _____

_____

_____

Name of Surety _____

Name of Contracting Body North Carolina
County of Cabarrus

Amount of Bond: _____ Dollars ($_____)

Project: Cabarrus County
Construction and Demolition Debris Landfill Phase 1L Expansion Project

KNOW ALL MEN BY THESE PRESENTS, that we, the PRINCIPAL and SURETY above named, are held and firmly bound unto the named Contracting Body, hereinafter called the Contracting Body, in the penal sum of the amount stated above for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal entered into a certain Contract with the Contracting Body, identified as shown above and hereto attached:

NOW THEREFORE, if the Principal shall well and truly perform and fulfill all the undertakings, covenants, terms, conditions, and agreements of said Contract during the original term of said Contract and any extensions thereof that may be granted by the Contracting Body, with or without notice to the Surety, and during the life of any guaranty required under the Contract, and shall also well and truly perform and fulfill all the undertakings, covenants, terms, conditions, and agreements of any and all duly authorized modifications of said Contract that may hereafter be made, notice of which modifications to the Surety being hereby waived, then, this obligation to be void; otherwise to remain in full force and virtue.

IN WITNESS WHEREOF, the above-bounden parties have executed this instrument under their several seals on the date indicated above, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its countersigned representative, pursuant to authority of its governing body.

PERFORMANCE BOND

Executed in Four (4) Counterparts.

CONTRACTOR:

By: _____

Title: _____
(Corporation President or
Vice President Only)

ATTEST: (Corporation)

_____
(Corporation Secretary or Assistant
Secretary Only) (CORPORATE SEAL)

SURETY COMPANY:

WITNESS: By:_____

_____ Title:_____
(Attorney in Fact)

(SURETY CORPORATE SEAL)

COUNTERSIGNED

_____

_____
(N.C. Licensed Resident Agent)

_____

_____
Name and Address-Surety Agency

_____

_____
Surety Company Name and N.C.
Regional or Branch Office Address

SECTION 00650

NOTICE OF AWARD

Dated _____

TO:_____
(Bidder)

PROJECT: Cabarrus County Construction and Demolition Debris Landfill Phase 1L Expansion

CONTRACT FOR Cabarrus County Construction and Demolition Debris Landfill Phase 1L Expansion

You are notified that your Bid dated_____, 200__ for the above Contract has been considered. You are the apparent successful Bidder and will be recommended for award of a Contract (at the regularly scheduled Board of County Commissioners meeting _____, 20___ for:_____
_____(Indicate total Work and alternates awarded)

The Contract Price of your contract is_____
_____
Dollars ($_____).

Enclosed are five (5) copies of the Contract Documents for your execution and subsequent return to this office for further processing.

You must comply with the following conditions precedent within fifteen (15) calendar days of the date of this Notice of Award, that is by _____, 20___:

1. Execute all copies of the Agreement. Each Project Manual and set of contract drawings must bear your signature and seal on the cover sheet. Do not date the Agreements or bonds; this will be accomplished upon execution of the contracts by the Owner. Submit a power of attorney authorizing Owner to date bonds and Agreements.

2. Submit five (5) copies of the Performance-Payment Bonds. Instructions to the Surety and the Principal for execution of the bonds are as follows:

   Where the Contractor is a Corporation, the Agreement and any bonds must be executed by the President or the Chairman of the Board of the corporation. The Agreement or Bond is accompanied by a statement certified by a Secretary of the Corporation. The signatures of the persons executing the bond on behalf of the Principal and of the Surety, respectively, shall each be dated on the signature line. If the bond is executed by an Attorney-in-Fact for the Surety, the accompanying Power of Attorney must be executed by persons whose authority to do so is plainly identified on the face of the Power of Attorney.

   Neither signatures nor the Corporate Seal may appear by facsimile unless the authority for them to appear in that form is plainly disclosed on the face of the document. The Secretary or other properly authorized Officer must certify and seal a statement declaring that the authority granted by the Power of Attorney remained in force on the date that the bond was executed by the Attorney-

in-Fact.

3. Include five (5) copies of the Certificate of Insurance. The Certificate must name County of Cabarrus, North Carolina, Camp Dresser & McKee (Engineer), and Engineer's Consultants as additional insureds and the standard cancellation clause must read as follows:

"Should any of the above described policies be cancelled or changed by restricted amendment before the expiration date thereof, the issuing Company will give thirty (30) days written notice to the below named certificate holder: County of Cabarrus, North Carolina."

Failure to comply with these conditions within the time specified will entitle Owner to consider your Bid abandoned, to annul this Notice of Award and to declare your Bid Security forfeited.

The Owner shall deliver one fully signed counterpart of the Contract Documents attached to the Contractor before or at the Pre-Construction Conference which is scheduled for _____, 200__.

If you have any questions, or if we can be of any further assistance, please do not hesitate to contact this office.

Sincerely,

_____

Cabarrus County Board of Commissioners

SECTION 00660

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE OF AWARD is hereby acknowledged by this the _____ day of _____, 20___.

By: _____

Title: _____

SECTION 00670

NOTICE TO PROCEED

Date: _____

To: _____

Address: _____

_____

_____

Project Description: _____

_____

_____

You are hereby notified to commence work in accordance with the Agreement dated _____, 20___ on or before _____, 20___ and you are to complete the WORK within _____ calendar days thereafter. The date of completion of all WORK is therefore _____, 20___.

_____
County of Cabarrus
Owner

BY: _____

TITLE: _____

ACCEPTANCE OF NOTICE

Receipt of the NOTICE TO PROCEED is hereby acknowledged.

_____
Contractor

BY: _____

TITLE: _____

DATE: _____

GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

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ARTICLE 1. DEFINITIONS

1.1 Agreement - The Construction Agreement, these General Conditions, and any Supplementary Conditions.

1.2 AIA - The American Institute of Architects.

1.3 ASTM - The American Society for Testing and Materials.

1.4 Beneficial Occupancy – The point at which the Project can be occupied by the Owner for its intended purpose, upon achievement of Substantial Completion, as defined in 1.40.

1.5 Change Order - A written order to the Contractor signed by the Owner and the Designer authorizing an addition, deletion, or revision in the Work and/or an adjustment in the Contract Price and/or the Contract Time issued after execution of the Construction Agreement. See paragraph 14.1.

1.6 Completion Date - Those dates identified as Completion Dates in the Contract Construction Schedule or elsewhere in the Contract Documents.

1.7 Construction Agreement – The document executed by the Contractor and the Owner to formally memorialize their consent to the terms of the Agreement.

1.8 Construction Change Directive – A written order to the Contractor signed by the Owner and the Designer directing an addition, deletion, or revision in the Work after execution of the Construction Agreement, in circumstances when the parties have been unable to agree on an adjustment to the Contract Price or the Contract Time, but the Owner requests that the Contractor proceed with said Work subject to adjustment of the Contract Price and/or Contract Time under the procedures described herein.

1.9 Construction Manager(s) - The person or firm designated as the Construction Manager in the Contract Documents, or their authorized representatives. The Construction Manager(s), as referred to herein, will be referred to hereinafter as if each were of the singular number, masculine gender.

1.10 Contract Construction Schedule - That schedule described in Article 13 hereof and identified as the Contract Construction Schedule.

1.11 Contract Documents - All of the documents that make up the Agreement, plus the Drawings and Specifications that describe the scope of the Work, plus allowable Modifications to the Contract Documents.

1.12 Contract Price - The total monies payable to the Contractor under the Contract Documents pursuant to paragraph 15.1 of the Agreement.

1.13 Contract Time - The number of calendar days stated in, or computed from, the Contract Documents for the completion of the Work, or any portion thereof. See, particularly, Article 13 hereof and the Contract Construction Schedule. Time of completion as specified therein is of the essence. The time used and referred to on the Project will be that time which is

observed in Raleigh, North Carolina, being Eastern Daylight Savings Time (EDT), Eastern Standard Time (EST), or other as designated by the Designer.

1.14 Contractor - The Contractor shall be that party identified as such in the Agreement.

1.15 Days - Unless otherwise indicated, the term "days" shall mean consecutive calendar days.

1.16 Daylight Hours - The hours or portions of hours between sunrise and sunset local time.

1.17 Designer(s) – The person or firm designated as the Designer in the Contract Documents, or their authorized representatives. The Designer(s), as referred to herein, shall mean architect, landscape architect, and/or engineer. They will be referred to hereinafter as if each were of the singular number, masculine gender.

1.18 Drawings - The Drawings are the graphic and pictorial portions of the Contract Documents, wherever located and whenever issued, showing the design, location, and dimensions of the Work, and generally including plans, elevations, sections, details, schedules and diagrams. A list of the Drawings is contained in the Supplemental General Conditions.

1.19 Field Order - A written order issued by the Designer which clarifies or interprets the Contract Documents or orders minor changes in the Work in accordance with the Contract Documents. See paragraph 14.2.

1.20 Final Completion - The point at which the Contractor has, as determined by the Designer, completed the Work, with the exception of guaranty and warranty obligations, and becomes entitled, upon the recommendation of the Designer and determination by the Owner, to final payment.

1.21 The words "furnish," "furnish and install," "install," and "provide" or words with similar meanings shall be interpreted, unless otherwise stated, to mean furnish and install complete, in place and ready for service.

1.22 Liquidated Damages – See paragraph 13.18 of these General Conditions.

1.23 Modification - (A) a written amendment to the Contract Documents signed by the Owner and the Contractor and identified therein as such, (B) a Change Order, (C) Construction Change Directive, or (D) a Field Order. A Modification may only be issued after execution of the Agreement.

1.24 Notice of Award - The written notice by the Owner to the Contractor that the Contractor is the successful Bidder and that upon compliance with the conditions precedent to be fulfilled by the Contractor within the time specified, the Owner will execute and deliver the Agreement to him.

1.25 Notice to Proceed - See paragraph 13.3.

1.26 Owner - The Owner is the person designated as such in the Agreement.

1.27 Owner's Authorized Representative - A person, or persons, employed by the Owner and designated from time to time by written notice to the Contractor to administer the Contract Documents, and to observe and monitor the Work on behalf of the Owner with authority and responsibility as herein specified.

1.28 Notice - The term "notice" or "written notice" as used herein shall mean and include all written notices, demands, instructions, and claims approvals and disapprovals furnished by the Owner or the Designer to obtain compliance with the requirements of the Contract Documents, as well as all written notices, demands, instructions and claims furnished by the Contractor as required by the Contract Documents. Where notice is required under the terms of the Contract Documents written notice shall always be required, and oral or "constructive" notice shall be insufficient and ineffective as notice. Email or other electronic delivery shall be insufficient and ineffective as notice unless specifically allowed by the Supplementary Conditions or a Modification to the Agreement. Written notice shall be deemed to have been duly served on the date that it is delivered in person to the individual or to a member of the firm, to an officer of the corporation for whom it is intended, to an authorized representative of such individual, firm, or corporation, or on the date that it is mailed by registered or certified mail, return receipt requested, addressed to the last business address of such individual, firm, or corporation known to the person giving the notice. Written notice may also be given by facsimile transmission, provided that proof of delivery is obtained. In the case of delivery in person, such delivery shall not be effective unless and until a written and signed receipt showing the date and time of delivery is obtained.

1.29 Project - The total construction of which the Work performed under the Contract Documents may be the whole or a part.

1.30 Project Expediter – As used herein, is an entity stated in the Contract Documents, designated to effectively facilitate scheduling and coordination of Work activities. For the purpose of a single prime contract, the single prime contractor is designated as the Project Expediter. For the purpose of a project involving separate prime contracts, the Contractor for general work shall be designated as the Project Expediter unless otherwise indicated in the Supplementary General Conditions. See paragraph 7.27.

1.31 Project Manager - That person designated by the Contractor in accordance with paragraph 7.2 who shall be in general charge of the Work and its performance and who shall have the authority set forth in the last sentence of paragraph 7.2.

1.32 Request for Information - A written communication from the Contractor to the Designer for any interpretation of, or information needed, required, or desired under the Contract Documents. The Owner reserves the right to determine the reasonable format and contents required for a Request for Information. In any Request for Information, the Contractor shall state a reasonable date by which a response is necessary in order to avoid delay in progress on the Work and shall make such request sufficiently in advance of such date as to avoid any such delay. The Designer shall respond in writing to the Request for Information by the date stated by the Contractor unless he cannot reasonably do so, in which case he shall prior to that date notify the Contractor of the date by which he can reasonably respond. The Contractor shall not be entitled to any additional time for the completion of the Work or any portion thereof by reason of the Designer's failure to respond

if he has not submitted his Request for Information sufficiently in advance to allow the Designer a reasonable time within which to respond.

1.33 Request for Payment - The form, in the form of AIA Document G702 (latest ed.) or other published document approved by Owner, which is to be used by the Contractor in requesting progress payments and which is to include a Schedule of Values as required by the Contract Documents and an affidavit of the Contractor that progress payments theretofore received from the Owner on account of the Work have been applied by the Contractor to discharge in full all the Contractor's obligations incurred in connection with Work covered by all prior applications for payment. See paragraph 20.2.

1.34 Resident Superintendent - That person designated by the Contractor in accordance with paragraph 7.2 who has day-to-day responsibility for the prosecution of the Work and the obtaining of proper materials and equipment, and adequate labor and who shall have the authority set forth in the last sentence of paragraph 7.2.

1.35 Schedule of Values - Any breakdown of the Contract Price which may be required by the Contract Documents, and designated as such. See paragraph 20.1.

1.36 Specifications - That portion of the Contract Documents consisting generally of the written requirements for materials, equipment, construction systems, standards, and workmanship for the Work and performance of related services.

1.37 Subcontractor - A person, firm, or corporation who has entered into a direct contract with the Contractor to perform any of the Work at the Project.

1.38 Submittal - Shop drawings, product data, samples, and other documents required by the Contract Documents to be submitted by the Contractor to the Designer.

1.39 Submittal Register - See paragraph 13.2 of these General Conditions.

1.40 Substantial Completion - The point at which the Work, and Work by other Contractors on or in connection with the Project, as determined by the Designer, is sufficiently complete in accordance with the Contract Documents that it can be beneficially occupied by the Owner, and the Work can be utilized by the Owner for its intended use, and all necessary permits and permissions for Beneficial Occupancy and utilization having been obtained by the Contractor. All operations and maintenance manuals, Owner training, and as-built drawings must be submitted prior to Substantial Completion being achieved.

1.41 Sub-subcontractor - A person or entity that has a direct or indirect contract with a Subcontractor to perform any of the Work at the Project.

1.42 Work - The construction and services required by the Contract Documents, including all labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations.

1.43 All references in the Contract Documents to the masculine shall be interpreted as including the feminine or neuter and all references in the Contract Documents to the singular or the

plural shall be interpreted as including the other, as may be appropriate in the reasonable interpretation of the Contract Documents.

ARTICLE 2. CORRELATION, INTERPRETATION AND INTENT OF CONTRACT DOCUMENTS

2.1 It is the intent of the Specifications and Drawings and other Contract Documents to describe a complete Project in accordance with the Contract Documents.

2.2 The Contract Documents are complementary; what is called for by one is as binding as if called for by all. If the Contractor finds a conflict, error or discrepancy in the Contract Documents, the Contractor shall notify the Designer in writing before proceeding with the Work affected thereby. In resolving such conflicts, errors and discrepancies, the Contract Documents shall be given preference in the following order: Construction Agreement, Modifications, Addenda, Supplemental Conditions, General Conditions, Specifications, and Drawings. Figure dimensions on Drawings shall govern over scale dimensions, and detailed Drawings shall govern over general Drawings. Any Work that may reasonably be inferred from the Contract Documents as being required to produce the intended result shall be supplied whether or not it is specifically called for. Work, materials or equipment described in words which, so applied, have a well known technical trade meaning shall be deemed to refer to such meaning and to incorporate any recognized standards which are a part of such meaning.

2.3 Miscellaneous items, accessories and work which are not specifically mentioned, but which are essential to produce a complete and properly operating installation, or useable structure or plant providing the indicated function shall be furnished and installed without change in the Contract Price. Such miscellaneous items and accessories shall be of the same quality standards, including material, style, finish, strength, class, weight and other applicable characteristics, as specified for the major component of which the miscellaneous item or accessory is an essential part, and shall be approved by the Designer before installation. This requirement is not intended to include major components not covered by or inferable from the Contract Documents.

2.4 The Work of all trades under the Contract Documents shall be coordinated by the Contractor in such a manner as to obtain the best workmanship possible for the entire Project and all components of the Work shall be installed or erected in accordance with the best practices of the particular trade.

2.5 The Contractor shall fully complete the Work and shall be responsible for all of the Work under the Contract Documents to which the Construction Agreement applies. If the Contractor is prevented from doing so by any limitation of the Contract Documents, the Contractor shall immediately give notice thereof to the Designer and the Owner in writing before proceeding with the construction in the area where the problem or limitation exists.

2.6 Standard specifications or manufacturers' literature, when referenced, shall be of the latest revision or printing unless otherwise stated and is intended to establish the minimum requirements acceptable.

2.7 For those materials specified without the use of brand names, the Contractor shall submit within thirty (30) days after his receiving the Construction Agreement for signatures, any product that meets the express requirements of the Specifications.

Such Submittal shall include manufacturer's data, test reports, performance data and certifications, samples, erection details, and other applicable information as required to permit determination by the Designer whether such proposed products are suitable. The Designer shall be the sole judge as to the suitability of any proposed product. The burden of proof of quality rests with the Contractor.

2.8 The Contractor is required to examine and read the complete set of Contract Documents for information concerning the Work, because some of the Work for which the Contractor will be responsible may be indicated on or in documentation applying primarily to the Work of one or more other separate prime contractors. No allowance will be made for the Contractor's failure to become familiar with the complete set of project documents.

2.9 Contractor's requests for clarification or information shall clearly define the cause(s) of Contractor's request and, as appropriate, shall include Contractor's interpretation and Contractor's proposed solution.

ARTICLE 3. FAMILIARITY WITH WORK, CONDITIONS AND LAWS

3.1 The Contractor has investigated prior to bidding and is satisfied with all conditions affecting the Work, including but not restricted to those bearing upon transportation, disposal, handling and storage of materials, availability of labor, water, electrical power, roads and uncertainties of weather, or similar physical conditions at the Project site, and the character of equipment and facilities needed prior to and during prosecution of the Work. The Contractor is satisfied as to the character, quality and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from inspection of the Project site, including all exploratory work done by the Owner, as well as from information presented by the Contract Documents, or any other information made available to the Contractor prior to receipt of bids. Any failure by the Contractor to become acquainted with the available information shall not relieve the Contractor from the responsibility for estimating properly the difficulty or cost of successfully performing the Work.

3.2 The Contractor shall be entitled to rely upon all information furnished to the Contractor in writing by the Owner with respect to the Project site and to make all inferences from it that would reasonably be made by a contractor having knowledge and experience with similar work; however, the Contractor shall not be entitled to infer from Owner-supplied information any fact or condition which would not be inferred by a contractor having knowledge and experience with similar work and, if the Owner-supplied information is inadequate or insufficient in any respect, the Contractor shall be required to obtain independently such other information as a knowledgeable and experienced contractor would prudently obtain in order to evaluate any such condition.

3.3 The Contractor specifically acknowledges familiarity with all Federal, State, and local laws, ordinances, rules, and regulations which may in any manner affect those engaged or

employed in the Work, or the materials or equipment in or about the Work, or in any way affect the conduct of the Work and agrees that the Contractor and the Contractor's employees, subcontractors, and suppliers will, at all times, comply with same. If the Contractor shall discover any provisions in the Contract Documents which are contrary to or inconsistent with any such law, ordinance, rule, or regulation, the Contractor shall immediately give notice thereof to the Designer and the Owner in writing, identifying any items of Work affected, and the Contractor shall not proceed until the Contractor has received written direction from the Designer with respect to these items. If the Contractor performs contrary to or inconsistently with any such law, ordinance, rule, or regulation without giving such notice, the Contractor shall bear all costs which are a consequence of such performance.

3.4 At times selected by the Designer after execution by the Contractor of the Construction Agreement, a pre-construction conference shall be scheduled and conducted for the benefit of the Project.

ARTICLE 4. BONDS

4.1 A performance bond in the full amount of the Contract Price shall be required of the Contractor to guarantee the faithful performance of the Work in compliance with the Contract Documents, in such form as may be required by law and approved by the Owner. The bond shall be dated the same date as the Construction Agreement and must be accompanied by a current copy of the power of attorney for the attorney-in-fact executing such bond on behalf of a surety company licensed to do business in the state of North Carolina.

4.2 A payment bond in the full amount of the Contract Price shall be required of the Contractor to guarantee the payment of all labor and material costs or claims in connection with compliance with the Contract. The payment bond shall be in such form as may be required by law and approved by the Owner. Said bond shall be dated and executed in the same manner as the performance bond in paragraph 4.1.

ARTICLE 5. INSURANCE AND INDEMNITY

5.1 CONTRACTOR PROVIDED INSURANCE

The Contractor shall, without limiting its obligations or liabilities, procure, pay for and maintain such insurance as is required by law and as is required by this Agreement to protect the Contractor and the Owner from claims for damages for bodily injury, including death, and from claims for property damage which may arise from the Contractor's or its representatives', consultants', Subcontractors', agents', or employees' operations under this Agreement. Such insurance shall be of the kinds and have limits of liability and coverages not less than the minimum limits hereinafter specified or required by law, whichever is greater. The Owner makes no representation as to the adequacy or sufficiency of such coverages. The following requirements shall in no way be construed to limit or eliminate the liability of the Contractor, which arises from performance of Work under the Agreement. The Contractor is strictly responsible for any losses, claims, and costs of any kind which exceed the Contractor's limits of liability, or which may be outside the coverage scope of the policies.

The insurance specified shall be provided by an insurer approved by the Owner, authorized to do such business in the State of North Carolina, and on terms approved by the Owner. Insurance companies utilized shall have a minimum rating of A- and Class VII as evaluated by the most current A.M. Best Rating Guide. If the insurer has a Best Rating less than A- and Class VII, the Contractor must receive specific written approval from the Owner prior to proceeding with any Work under the Agreement. All agents and brokers shall hold valid licenses from the State of North Carolina. Before commencing mobilization to the Project site and not later than 7 days after the receipt of the Construction Agreement by the Contractor for signatures, the Contractor shall furnish to the Owner a certificate or certificates of insurance in a form satisfactory to the Owner. Upon request of the Owner, the Contractor shall provide the Owner with certified copies of the insurance policies required by this Article, including without limitation declaration pages, conditions, exclusions and endorsements, and confirmation that each policy premium has been paid for the required term of this Agreement. Certificates shall be signed by a person authorized by that insurer to bind coverage on its behalf. All insurance policies shall provide, as evidenced by Certificates of Insurance, that the insurance shall not be canceled, reduced, restricted, or changed in any way without at least 30 days prior written notice to the Owner. With regard to expiration, cancellation, reduction, restriction, or any other change, certificates shall state: "Should any of the following described policies be canceled before expiration date or be due to expire within 30 days, the insurer shall mail 30 days prior written notice to named certificate holder." In the event of any such cancellation, non-renewal, reduction, restriction, or change in any insurance, the Contractor is obligated to replace such insurance within 7 days without a gap in coverage and file accordingly such notice with the Owner, and other interested parties. Failing immediate receipt of evidence of such replacement of insurance the Owner reserves the right to procure such insurance as the Owner considers desirable and the Contractor shall pay or reimburse the cost of the premium in respect thereof. It is expressly provided, however, that any action or inaction on the part of the Owner in this respect shall in no way change or reduce the Contractor's responsibilities and liabilities under this Agreement. Self-funded, policy fronting, or other non-risk transfer insurance mechanisms are not acceptable without prior written approval of the Owner. Full disclosure of such a program must be made prior to commencing mobilization to the Project site. Failure to make a full disclosure constitutes a material breach of the Agreement, justifying termination for default.

The Contractor shall name the Owner, the Designer, the Designer's consultants, and the Construction Manager as additional insureds under all its insurance contracts (except workers' compensation) with respect to and including without limitation liability arising out of activities performed by or on behalf of the Contractor, products and completed operations of the Contractor, and automobiles owned, hired, leased, or borrowed by the Contractor. The coverage shall contain no special limitations on the scope of protection afforded to additional insureds.

For any claims related to this Project, the Contractor's insurance or self insurance shall be primary and noncontributory with respect to the Owner's insurance. Any insurance or self-insurance maintained by the Owner shall be excess and noncontributory with respect to the Contractor's insurance.

All policies of insurance shall contain a clause waiving rights of subrogation against the Owner, unless the Owner approves otherwise in writing.

Limits of coverage are not to be amended by deductible clauses of any nature without the express written consent of the Owner. The Contractor shall be solely responsible for any deductible assumptions that may exist in any insurance policies required under this Agreement. In addition, the Contractor shall be responsible and shall not be reimbursed for any losses arising from any risk or exposure not insured as required herein, or not covered as a result of a normal policy exclusion or that falls within the self insured retention, if Contractor self insured.

The Contractor's insurance shall apply separately to each insured against whom claim is made or suit is brought, except with respect to the limits of the insurer's liability.

The claim provisions in the Contractor's insurance policies must specifically state the insurance company or Contractor's Third Party Administrator, if self insured, has both the right and duty to adjust a claim and provide defense.

The policies shall not contain any provision or definition which would serve to exclude or eliminate from coverage third party claims, including exclusions of claims for bodily or other injury to shareholders, partners, officers, directors, or employees of the insured, the premises owner, real estate manager, or the insured's Subcontractor, or any family relative of such persons.

If the policies contain any warranty stating that coverage is null and void (or words to that effect) if the Contractor does not comply with the most stringent regulations governing the Work, it shall be modified so that coverage shall be afforded in all cases except for the Contractor's willful or intentional noncompliance with applicable government regulations.

Any failure by any person to comply with reporting or other provisions of the policy including breach of warranties, shall not affect coverage provided to the Owner and its representatives, officials, and employees.

The insolvency or bankruptcy of the Insured or of the Insured's estate shall not relieve the insurance companies of their obligations under these policies. Any clauses to the contrary are unacceptable and must be stricken.

Failure to comply with these requirements shall be a material breach of this Agreement justifying termination for default.

5.1.1 Worker's Compensation and Employers' Liability Insurance

The Contractor and its Subcontractors shall procure and maintain Workers' Compensation Insurance in the amount and type required by the State of North Carolina and federal law for all employees employed under the Agreement who may come within the protection of Workers' Compensation Laws and covering all operations under the Agreement whether performed by the Contractor or by his Subcontractors. In jurisdictions not providing complete Workers' Compensation protection, the Contractor and his Subcontractors shall maintain employers' liability insurance in an amount, form, company, and agency

satisfactory to the State of North Carolina and the Owner for the benefit of all employees not protected by Workers' Compensation Laws and covering all operations under the Agreement whether performed by the Contractor or by his Subcontractors.

The Contractor shall pay such assessments as will protect the Contractor and the Owner from claims under the Workers' Compensation Laws, workers' or workmen's compensation disability benefits, and other similar employee benefit acts. The current Experience Modification Factor shall be indicated on the Certificate of Insurance.

Coverage under this section shall be as required by federal and state Workers' Compensation and Occupational Disease Statutes, and shall have minimum limits as follows:

Coverage A:		Statutory, State of North Carolina
Employers' Liability:	Each Accident	$1,000,000
	Disease - Policy Limit	$1,000,000
	Disease - Each Employee	$1,000,000

Such insurance shall include Voluntary Compensation coverage, a Waiver of Subrogation in favor of the Owner as well as other endorsements that may be required by applicable jurisdictions, i.e. United States Longshoremen and Harbor Workers Act and maritime coverage (Jones Act).

5.1.2 Automobile Liability Insurance

The Contractor shall procure and maintain automobile insurance against liability for bodily injury and property damage as described below, that may arise with respect to the Work being performed under the Agreement, and as will provide protection from claims which may arise out of or result from the Contractor's performance of the Work and the Contractor's other obligations under the Agreement, whether such performance of the Work is by the Contractor, by any representative or Subcontractor, by anyone, both officially and personally, directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable.

This policy of insurance shall carry the following minimum Limit of Liability:

Combined Single Limit	$1,000,000

The policy of insurance shall contain or be endorsed to include the following:

a) owned, hired, and non-owned automobile liability.

b) If the policy contains a warranty stating that coverage is null and void (or words to that effect) if the transporter does not comply with the most stringent regulations governing the Work, it shall be modified so that coverage shall be afforded in all cases except for the transporter's willful or intentional noncompliance with applicable government regulations.

Any failure by any party to comply with reporting or other provisions of the policy including breach of warranties, shall not affect coverage provided to the Owner and its representatives, officials, and employees.

No subcontracting of waste hauling shall be permitted without prior, written approval of the Owner.

5.1.3 General Liability

This policy must be written on an Occurrence basis, with the following minimum Limits of Liability:

General Aggregate per project	$2,000,000.00
Products/Completed Operations Aggregate	$2,000,000.00
Bodily Injury and Property Damage csl/each occurrence	$1,000,000.00
Personal Injury and Advertising Injury	$2,000,000.00

The policy of insurance shall contain or be endorsed to include the following:

a) Blanket Contractual Liability covering Contractor's indemnification obligations under this Agreement, in accordance with ISO policy form CG 00 01. Modifications to the standard provision will not be acceptable if they serve to reduce coverage.

b) Premises/Operations Liability.

c) Explosion, collapse, and underground fault.

d) Independent Contractors and Independent Subcontractors coverage.

e) Broad Form Property Damage.

f) Personal Injury

g) Cross Liability/Severability of Interest clause.

h) Employer's Stop-Gap Liability endorsement, if applicable.

i) Amendment of the Pollution Exclusion Endorsement to allow coverage for bodily injury or property damage caused by heat, smoke, or fumes from a hostile fire.

j) Designated General Aggregate Limit Endorsement if required by the Supplemental General Conditions.

Coverage shall remain continuously in effect and without interruption for at least 6 years from the date of the Notice of Award and shall include coverage for exposures arising from operations that have been completed. The Contractor shall furnish the Owner and each other additional insured listed in the Agreement to whom the Certificates have been issued, evidence satisfactory to the Owner of continuation of such insurance at the date of Preliminary Acceptance and each year thereafter.

5.1.4 Pollution Legal Liability (PLL)

Pollution Legal Liability coverage will be provided if required by the Supplementary General Conditions.

5.1.5 Umbrella Liability

The Contractor shall maintain an occurrence basis (as distinguished from a "claims made" basis) Umbrella Liability policy (true follow form) over the underlying General Liability, Automobile Liability, and Employer's Liability, with the following limits of liability:

Each Occurrence	$3,000,000
Aggregate	$3,000,000

On a fully insured basis such coverage will be subject to a deductible no greater than $10,000 per occurrence where coverage is not provided by the underlying insurance, but is provided by the Umbrella Liability policy.

The Contractor may use any combination of primary and umbrella insurance policies to comply with the insurance requirements, provided the resulting insurance is equivalent to the insurance stated herein.

All Occupational Disease exclusions must be deleted. Any Pollution Exclusion must be amended to allow coverage for bodily injury or property damage caused by spill, upset, overturn, heat, smoke, or fumes from a hostile fire.

5.1.6 Property Insurance

The Contractor shall purchase All Risk Property Insurance on a Completed Value Form in the names of the Owner, Contractor, Subcontractors, and sub-subcontractors as their interests may appear with limits as follows:

a) Full insurance value of the Work, or

b) Amount equal to the Contract Price for the Work, whichever is higher.

The Contractor is responsible for all physical damage to owned or rented machinery, tools, equipment, forms, and other items owned, rented or used by the Contractor and/or Subcontractor(s) in the performance of the Work. The insurance coverage evidencing such shall include a waiver of subrogation in favor of the Owner.

5.1.7 Valuable Papers And Records

The Contractor shall provide valuable papers and records insurance with coverage in an amount commensurate with project scope and set forth in the Supplementary General Conditions.

5.1.8 Claims

The Contractor shall notify the Owner within 24 hours of any claims or alleged claims received by the Contractor covered by any of the policies of insurance required in this Agreement. The Contractor shall provide a written copy of the claim or alleged claim to the Owner within 3 days of the Contractor's receipt of the claim or alleged claim. If a claim is settled to the satisfaction of the claimant, the Contractor shall submit a copy of the claimant's release to the Owner.

If a claim or alleged claim is rejected by the Contractor and/or its insurance company, the Contractor shall immediately report this fact to the Owner.

Should 30 days elapse after the claim or alleged claim has been received by the Contractor, and the Contractor is not able to report a settlement or rejection of the claim, it shall report to the Owner the steps being taken with respect to the claim.

Without limiting the foregoing, he Contractor shall notify in writing the county risk manager of any paid or incurred claims which may impair annual aggregate or general liability.

5.1.9 Deductibles and Self-insured Retentions

Any deductibles or self-insured retentions must be declared to and approved by the Owner. At the option of the Owner, either: the insurer shall reduce to a maximum of $250,000 or eliminate such deductibles or self-insured retentions with respect to the Owner, or the Contractor shall provide evidence of collateral provided to insurers or procure a bond guaranteeing payment of losses and related investigations, claim administration, and defense expenses within the deductible or self-insured retention amount. Any self-insured retention or deductible amount on the policy shall not reduce the amount of collectible limits or liability.

5.1.10 Subcontractors

The Contractor shall include all Subcontractors as Insureds under its policies, or shall furnish separate certificates, policies, and endorsements for each Subcontractor the Contractor intends to use. If a Subcontractor does not take out insurance in his own name and the Contractor wishes to provide insurance protection for such Subcontractor and such Subcontractor's employees, the Contractor shall either (a) procure appropriate policies in the name of the Subcontractor, or (b) cause a rider or riders to be attached to the Contractor's policies which shall identify the Subcontractor thereby covered; provided, however, in the case of the latter option, such a rider need not be attached to the Contractor's workers' compensation policy if such policy by its terms is sufficiently broad to cover the employees of all Subcontractors performing Work under the Contract Documents. Except as otherwise approved by the Owner in writing, Limits of Liability and coverage scope must be at a minimum as stringent as required of the Contractor by the Contract Documents. All Work performed for the Contractor by any Subcontractor shall be pursuant to an appropriate agreement between the Contractor and the Subcontractor which shall contain provisions that waive all rights the contracting parties may have against one another for damages caused by fire or other perils covered by insurance as provided

herein. Insurance monies received from any loss shall be divided as the respective interest of the parties affected shall appear.

5.2 OWNER CONTROLLED PROJECT SPECIFIC INSURANCE

In the event the Owner elects to purchase project-specific insurance affording coverage to the Contractor and Subcontractors, the terms and conditions of such coverage shall be set forth in the Supplementary Conditions.

5.3 CONTRACTOR AS JOINT VENTURE

If the Contractor is completing this Project on a joint venture basis, both joint venture partners retain all liabilities assumed by this Agreement, individually and collectively. This may include, but is not limited to, all premiums due, deductibles/self-insured retentions, coinsurance provisions, claim provisions, insurance policy conditions, and indemnification provisions hereunder.

Evidence of a Blanket Joint Venture Endorsement must be obtained from the General Liability and Contractor's Pollution Legal Liability carriers of each joint venture partner for a period of 6 years after completion of the Project, substantially as follows:

With respect to "your work", and the "products-completed operations hazard", you are an insured for your liability arising out of the conduct of any partnership or joint venture of which you were a partner or member, even though this partnership or joint venture is not shown as a Named Insured in the Declarations. This coverage is excess over any available liability purchased specifically to insure the partnership or joint venture. This coverage will not inure to the benefit of any other party except you."

5.4 INDEMNIFICATION

The Contractor, to the fullest extent not expressly prohibited by law, shall defend, indemnify, and save harmless the Owner, the Designer, the Construction Manager and their respective officials, officers, employees, and agents from and against any and all liabilities (foreseeable or unforeseeable), penalties, fines, forfeitures, demands, claims, causes of actions, suits, judgments, and costs and expenses incidental thereto, (including, without limitation, amounts paid pursuant to investigations, defense or settlements, and reasonable attorneys' fees), which any or all of them may hereafter suffer, incur, be responsible for, or pay out as a result of but not limited to:

a) bodily injury (including sickness, disease, or death) to any person including but not limited to, the Contractor's employees or its representatives while on the site of the Project; or

b) actual or alleged damage (including loss of use) to any property (public or private, including the Project or other property on the Project site); or

c) contamination of or adverse effects on the environment arising directly or indirectly out of or in connection with the performance of the Work, including but not limited to any hazardous or toxic waste, substance, or constituent of any substance subject to

regulation under CERCLA, RCRA, TSCA, and other Federal and state authorities that is spilled, released, threatening to release, or disposed of or destroyed by the Contractor or its Subcontractors on or off the site of the Project or while in transport to or from the site; or

d) any violation or alleged violation of laws and regulations, arising out of or in any way connected with the Work,

caused in whole or in part by the Contractor, any Subcontractor or supplier or any representatives of the Contractor. The Contractor shall not be required to indemnify the Owner against losses resulting from a breach of this Agreement by the Owner or its other agents and contractors, or resulting from negligence, misconduct or violation of laws on the part of the Owner or its other agents and contractors.

The Contractor further agrees to obtain, maintain, and pay for such liability insurance coverages and endorsements as will insure the provisions of this paragraph. Furthermore, the Contractor agrees to be liable for and to indemnify and reimburse the Owner for all legal fees and disbursements paid or incurred to enforce the provisions of this paragraph. The indemnification obligations under this paragraph shall not be limited in any way by the amount or type of damages, compensation or benefits payable under worker's compensation acts, disability benefit acts, other employment benefit acts, or the amount of insurance carried or recovered.

The Owner acknowledges that hazardous or toxic waste, material, chemicals, compounds or substances, or other environmental hazards, contamination or pollution, (referred to hereinafter as "environmental hazards") may be present at the Project site that were not created, generated, or released at the Project site by the Contractor or its Subcontractors, agents or employees, acting alone or in concert with others. Unless the remediation, abatement or handling of such environmental hazards is part of the scope of the Work under this Agreement, then upon the discovery of such environmental hazards, the Contractor shall immediately, and in no event more than three days later, give notice to the Owner of the environmental hazards before they are disturbed beyond their initial discovery. The Owner and the Designer shall thereupon promptly investigate the environmental hazards, and make such changes in the Drawings and/or Specifications as they may find necessary to abate, remediate, isolate or handle the environmental hazards. Any increase or decrease in the Contract Price or the Contract Time resulting from such changes shall be adjusted in the manner provided herein for adjustments as to extra and/or additional Work and changes. It is agreed that the Contractor shall have no liability under this Agreement for any environmental hazards existing prior to the date that Work commences under this Agreement unless the Contractor or its Subcontractors, agents or employees, acting alone or in concert with others, by their own negligence or misconduct, release or expose the Owner or third parties to the environmental hazards.

The provisions of this paragraph shall survive the termination or cancellation or completion of this Agreement.

ARTICLE 6. OTHER RECORD DOCUMENTS AND SUBMITTALS

6.1 The Designer shall furnish to the Contractor the number of copies of Drawings and Specifications stated in the Supplementary General Conditions. Additional copies of Drawings and Specifications may be obtained at the cost of reproduction and handling.

6.2 The Contractor shall submit to the Designer all Submittals required by the Contract Documents. The Contractor shall submit three (3) reproducible prints of all shop drawings plus the number of copies sufficient for his requirements. The Contractor shall submit samples in quantities required by the Contract Documents. The Contractor shall submit product data in five (5) copies, plus the number of copies sufficient for the Contractor's requirements. All shop drawings shall be reviewed by the Contractor and shall bear the Contractor's stamp of approval before being forwarded to the Designer. Submittals shall be submitted in such time as to cause no delay to the Work or any part thereof and in accordance with the Contract Construction Schedule and Submittal Register. The Designer shall review the submittal with reasonable promptness, noting desired corrections, if any. The Designer shall retain two (2) copies of the submittal and shall return the balance of the reviewed submittal to the Contractor for action. The Contractor shall furnish any corrected submittal to the Designer. The Designer shall retain two (2) copies of the corrected submittal and will return the balance of the reviewed submittal to the Contractor.

No substitutions will be accepted after the bids have been received. All substitutions prior to the receipt of bids shall be in accordance with the Contract Documents. Refer to Instructions to Bidders, Paragraph 3, Substitutions.

The Contractor acknowledges that the processing of shop drawings and other submittals is directly impacted by the clarity, completeness, and accuracy of said documents and that it is the Contractor's responsibility to (i) review and coordinate each submittal with all other related or affected Work and (ii) approve each submittal before submitting same to the Designer for approval.

6.3 No substitutions and no deviations from any requirement of the Contract Documents shall be deemed allowed unless the Contractor has specifically informed the Designer and the Owner in writing of such deviations at the time of submittal and the Designer and the Owner have given written and specific approval to the substitutions or deviations. In proposing a deviation or substitution the Contractor warrants to the Owner, notwithstanding any review, allowance or approval by the Designer or the Owner that the deviation or substitution is at least equal to or better in quality and for the purpose intended, and that Contractor shall not by reason of any such review, allowance or approval be relieved from any obligation or responsibility contained in the Contract Documents.

6.4 Review of submittal by the Designer shall not be construed as relieving the Contractor from responsibility for compliance with terms or designs of the Contract Documents nor from responsibility for errors of any sort in the submittal.

6.5 The Contractor shall keep one record copy marked "As-Built" of all Specifications, Drawings, Addenda, Modifications, and Submittals at the Project in good order and annotated at least monthly to show all changes made during the construction process. Such monthly annotations and their approval by the Designer shall be a condition

precedent to approval by the Designer of each monthly Request for Payment. Said record copy shall be stored at the Project and fully protected from damage by fire or other hazard. This record copy shall be available to the Designer and Owner for inspection at all times and shall be delivered to the Designer for the Owner's purposes prior to the Designer's certifying Substantial Completion of the Work.

6.6 At completion of the Project and before Final Payment, the Contractor shall assemble and deliver to the Owner one complete set of all as-built drawings and one complete set of all approved submittals, product data, and samples which were reviewed by the Designer. These drawings and submittals shall be on paper, or in electronic or other media if required by the Supplementary Conditions. These drawings and submittals shall be categorized and packaged as directed by the Designer.

ARTICLE 7. CONTRACTOR

7.1 The Contractor shall supervise and direct the Work efficiently and with the Contractor's best skill and attention. Except as may be set forth specifically in the Contract Documents, the Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction, and for safety precautions and programs in connection with the Work. The Contractor shall be responsible to see that the finished Work complies accurately with the Contract Documents.

7.2 The Contractor shall appoint a Project Manager and shall keep on the Project at all times during its progress a competent Resident Superintendent and necessary assistants who shall not be replaced without prior written approval by the Owner except under extraordinary circumstances, in which event immediate written notice shall be given to the Designer and the Owner. The Project Manager and the Resident Superintendent may be the same person or different persons. At any time, the Owner, in its sole and absolute discretion, may require the Contractor to replace the Project Manager or Resident Superintendent with an experienced and competent person or persons upon seven (7) days written notice from the Owner to the Contractor. Such replacement shall be at the Contractor's expense and at no cost to the Owner.

Both the Project Manager and the Resident Superintendent shall have authority to act on behalf of the Contractor, and instructions, directions or notices given to either of them shall be as binding as if given to the Contractor.

7.3 The Contractor shall provide sufficient competent and suitably qualified personnel, equipment, and supplies to lay out the Work and perform construction as required by the Contract Documents. The Contractor will at all times maintain good discipline and order at the site, and will comply with all applicable OSHA standards.

Any person employed by the Contractor, any Subcontractor, or any sub-subcontractor who, in the opinion of the Designer or the Owner, does not perform his Work in a proper and skillful manner or is intemperate or disorderly shall, at the written request of the Owner or Designer, be removed forthwith by the Contractor, Subcontractor, or sub-subcontractor employing such person without cost to the Owner, and shall not be employed again in any portion of the Work without the written approval of the Owner or Designer.

Should the Contractor fail to remove such person or persons or fail to furnish suitable and sufficient personnel for the proper prosecution of the Work within three (3) days after written order, the Owner may withhold further payment by written notice until compliance with such order.

7.4 If, in the opinion of the Designer or the Owner, any Subcontractor on the Project is incompetent or otherwise unsatisfactory, he shall be replaced by the Contractor with no increase in the Contract Price if and when directed by the Designer or the Owner in writing.

7.5 The Contractor shall furnish all materials, equipment, labor, transportation, construction equipment and machinery, tools appliances, fuel, light, heat, and all other facilities and incidentals necessary for the execution, maintenance, initial operation, and completion of the Work, other than those specifically excluded by the Contract Documents and to be furnished by the Owner or others. When use or storage of hazardous materials or equipment or methods of more than ordinary risk are necessary in accomplishing the Work, the Contractor shall give the Owner and Designer reasonable advance notice.

If any materials are to be furnished or installed by the Owner or others under the terms of the Contract Documents, said materials shall be made available to the Contractor at the location(s) specified in the Contract Documents. All costs of handling, transportation from the specified location to the Project, storage, and installing of Owner-furnished materials shall be included in the Contract Price. The Contractor shall be responsible for any demurrage, damage, loss, or other deficiencies which may occur during the Contractor's handling, storage, or use of such Owner-furnished material. The Owner shall deduct from any monies due or to become due the Contractor any cost incurred by the Owner in making good any such damage, loss, or deficiency.

All equipment which is proposed to be used in the Work shall be of sufficient size and in such mechanical condition as to meet the requirements of the Work and produce a satisfactory quality of work. Equipment used on any portion of the Work shall be such that no injury to previously completed Work, adjacent property, or existing facilities shall result from its use.

When the methods and equipment to be used by the Contractor accomplishing the Work are not prescribed in the Contract Documents, the Contractor shall be free to use any methods or equipment that will accomplish the Work in conformity with the requirements of the Contract Documents.

When the Contract Documents specify the use of certain methods and equipment, such methods and equipment shall be used unless others are authorized by the Designer. If the Contractor desires to use a method or type of equipment other than specified in the Contract Documents, the Contractor may request authority from the Designer to do so. The request shall be in writing and shall include a full description of the methods and equipment proposed and of the reasons for desiring to make the change. If approval is given, it shall be on the condition that the Contractor shall be fully responsible for producing Work in conformity with the requirements of the Contract Documents. If, after trial use of the substituted methods or equipment, the Designer determines that the Work produced does not meet the requirements of the Contract Documents, the Contractor shall discontinue the use of the substitute method or equipment and shall complete the remaining Work with the

specified methods and equipment at no additional cost to the Owner. The Contractor shall remove any deficient Work and replace it with Work of specified quality, or take such other corrective action as the Designer may direct. No change in the Contract Price or in Contract Time shall be made as a result of authorizing a change in methods or equipment under this paragraph.

7.6 All materials and equipment shall be new, except as otherwise provided in the Contract Documents. When special makes or grades of material which are normally packaged by the supplier or manufacturer are specified or approved, such materials shall be delivered to the Project site in their original packages or containers with seals unbroken and labels intact.

Materials shall be so stored as to assure the preservation of their quantity, quality and fitness for the Work. Stored materials, even though approved before storage, may again be inspected by the Designer or Owner prior to their use in the Work and shall meet the requirements of the Contract Documents at the time they are incorporated into the Work. Stored materials shall be located so as to facilitate their prompt inspection. The Contractor shall coordinate the storage of all materials with the Designer and the Owner. Materials to be stored at the Project or on the Owner's property shall not create an obstruction to the Owner's or other contractor's reasonable activities. Private property shall not be used for storage purposes without written permission of the owner or lessee of such property. The Contractor shall make all arrangements and bear all expenses for the storage of materials on private property. Upon request, the Contractor shall furnish the Owner a copy of the property owner's permission. All storage sites on private or the Owner's property shall be restored to their original condition by the Contractor at his entire expense, except as otherwise agreed to (in writing) by the owner or lessee of the property.

7.7 All materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with the instructions of the applicable manufacturer, fabricator, or processor, except as otherwise provided in the Contract Documents.

7.8 The Contractor will be fully responsible for all acts and omissions of his Subcontractors and of persons directly or indirectly employed by them and of persons for whose acts any of them may be liable to the same extent that the Contractor is responsible for the acts and omissions of the Contractor's own employees. Nothing in the Contract Documents shall create any contractual relationship between any Subcontractor or supplier and the Owner or the Designer, or any obligation on the part of the Owner or the Designer to pay or see to the payment of any money due any such Subcontractor or material furnisher except as may otherwise be required by law. The Owner or the Designer may furnish to any Subcontractor or supplier, to the extent practicable, evidence of amounts paid to the Contractor on account of specific Work done.

7.9 The divisions and sections of the Specifications and the identifications of any Drawings shall not control the Contractor in dividing the Work among Subcontractors.

7.10 The Contractor agrees to bind specifically every Subcontractor to the terms and conditions of the Contract Documents for the benefit of the Owner and to furnish written evidence thereof to the Designer and the Owner within seven (7) days after written request by the Owner.

7.11 The Contractor shall attend job progress conferences and all other meetings or conferences as directed by the Designer. The Contractor shall be represented at these job progress conferences by a representative having the authority of the Project Manager and by such other representatives as the Designer may direct. Job progress conferences shall be open to Subcontractors, suppliers and any others who may contribute beneficially toward maintaining required job progress, and such personnel shall be encouraged by the Contractor to attend. It shall be the principal purpose of job progress conferences to effect coordination, cooperation and assistance in every practical way toward the end of maintaining progress of the Project on schedule and to complete the Work and the Project by the specified Completion Dates. The Contractor shall be prepared to assess progress of the Work as required in the Contract Documents and to recommend remedial measures for correction of progress as may be appropriate. The Designer shall preside as chairman and arrange for minutes to be taken and circulated.

In the event that the prosecution of the Work is discontinued for any reason, the Contractor shall notify the Designer and the Owner at least forty-eight (48) hours in advance of resuming operations.

Should the terms of the Contract Documents require completion of one or more portions of the Work for the Beneficial Occupancy of the Owner prior to completion of the entire Work, the Contractor shall complete such portion(s) of the Work on or before the date specified. Such completion shall include the obtaining of all government or other permits, permission, and/or approvals necessary to occupancy. The Contractor shall independently estimate the difficulties involved in arranging the Work to permit such Beneficial Occupancy and shall not claim any additional compensation or time extension by reason of any delay or increased cost due to completing such portion(s) of the Work. The Owner's possession and use of such portion(s) of the Work shall not be deemed an acceptance of any Work not completed in accordance with the Contract Documents. The Owner shall be responsible for the security, maintenance, utilities, and insurance of all portions of the Work completed and beneficially occupied by the Owner.

7.12 The Contractor shall pay all license fees and royalties, and assume all costs incident to the use of any invention, design process, or device which is the subject of patent rights or copyrights held by others, except for inventions, design processes, or devices specified by the Designer in the Contract Documents. The Contractor shall indemnify and hold harmless the Owner, the Designer, and anyone directly employed by either of them, from and against all claims, damages, losses and expenses, including attorney's fees and costs of defense, arising out of any infringement or alleged infringement of such rights during or after completion of the Work, and shall defend all such claims in connection with any actual or alleged infringement of such rights.

7.13 The Contractor shall secure and pay for all permits, including without limitation construction permits and licenses, and will pay all governmental charges and inspection fees necessary for the prosecution of the Work.

7.14 The Contractor shall give all notices and comply with all laws, ordinances, rules, and regulations applicable to the Work and shall protect and indemnify the Owner and the Owner's officers, agents, or servants against any claim or liability arising from or based on

the violation of any such law, ordinance, regulation, order, or decree, whether by the Contractor or by the Contractor's employees, Subcontractors, sub-subcontractors, or their employees.

7.15 The Contractor shall be responsible for the entire site of the Project and for its reasonable and necessary protection and security, as required by laws or ordinances governing such conditions, or by custom or sound construction practices, and shall share such responsibilities as may be agreed upon among them, or in the absence of such agreement, as may be directed by the Contract Documents, Owner, or Designer. The Contractor shall be responsible for any damage to the Owner's property, or that of others, by the Contractor or the Contractor's employees, Subcontractors, sub-subcontractors, or their employees or agents, and shall make good such damages. The Contractor shall be responsible for and pay for any such claims against the Owner.

7.16 The Contractor shall protect all landscaping designated to remain in the vicinity of the operations and barricade all walks, roads, and areas as necessary to keep the public away from the construction.

7.17 The Contractor shall provide cover and/or protect all portions of the Work and provide all materials necessary to protect the Work whether performed by the Contractor or any of the Subcontractors or sub-subcontractors. Any Work damaged through the lack of proper protection, or from any other cause, shall be repaired or replaced without extra cost to the Owner or extension to the Contract Time.

The Contractor shall maintain the Work during construction and until the Work is accepted. This maintenance shall constitute continuous and effective effort prosecuted day by day, with adequate equipment and forces so that the Work is maintained in satisfactory condition at all times. All costs of maintenance shall be included in the Contract Price and the Contractor will not be paid an additional amount for such effort. Should the Owner or Designer observe that the Contractor at any time has failed to maintain the Work as provided herein, the Designer may immediately notify the Contractor of such non-compliance. Such notification shall specify a reasonable time within which the Contractor shall be required to remedy such unsatisfactory maintenance condition. Should the Contractor fail to properly respond to the Designer's notification, the Owner may, at the Contractor's expense, take such action as it may deem appropriate to remedy the defective maintenance, including suspension of the Contractor's Work or any part thereof. Any such expense incurred by the Owner shall be deducted from monies due or to become due the Contractor.

Parking lots, streets, and walks connecting to the Project area shall be protected by the Contractor from deposits of mud, sand, stone, litter, or debris in any form.

Pedestrian traffic areas around the construction limits must be maintained in a clean and safe condition at all times with required barricades and covered walkways. When excavation or other operations outside the Project limits is required, the Contractor shall, immediately following that work, return the area to its original condition.

All catch basins and storm drain lines in the vicinity of the Project site shall be protected at all times from entry of dirt, rubble and other debris. The residue from the cleaning of trucks,

wheelbarrows, concrete buggies, etc. must be prevented from entering the drainage system, and if cleaning is done, the residue must be contained and removed from the Project site with other refuse.

7.18 No burning of refuse or debris shall be allowed inside or around the Project during the course of construction without written authority from authorities having jurisdiction and the Owner.

7.19 The Contractor shall provide for and maintain necessary safety measures and safety programs for the protection of all persons involved with the Work. Such measures and programs shall include the requirements of the most current edition of the CAGC Safety and Health Manual [or the AGC Accident Prevention Manual in Construction], or equivalent requirements, and shall fully comply with all Federal, State, and local laws, rules, regulations, and building code requirements relating to the prevention of accidents or injuries to persons on or about the location of the Work.

All trenches, excavations, or other hazards in the vicinity of the Work shall be well barricaded, and properly lighted at night. When Work requires closing of an area normally used by the Owner or the public, the Contractor shall furnish, erect, and maintain temporary barricades, and properly light the area. The Contractor shall comply with any directions and public authorities in this respect.

7.20 The Contractor shall designate a responsible officer or employee as safety inspector, whose duties shall include accident prevention on the Project as well as implementation of the Contractor's safety measures and safety programs on the Project. The name of the safety inspector shall be made known to the Designer and the Owner at the pre-construction conference.

7.21 In emergencies affecting the safety of persons, the Work, or property at the Project site or adjacent thereto, the Contractor is obligated to act in the Contractor's discretion to prevent threatened damage, injury, or loss. As soon as practicable, the Contractor shall notify the Designer and Owner of such emergency. The Contractor shall give the Designer and the Owner prompt written notice of any significant changes in the Work or deviations from the Contract Documents caused by such emergency. If the Contractor believes that additional work done in an emergency entitles the Contractor to an increase in the Contract Price or an extension of the Contract Time, the Contractor may make a claim therefore as provided in Articles 14 and/or 15.

7.22 The Contractor shall at all times keep the premises free from accumulation of waste materials or rubbish caused by the Work. At least weekly and at the completion of the Work, the Contractor shall remove all waste materials and rubbish from and about the Project. At the completion of the Work, the Contractor shall remove all tools, construction equipment, machinery, and surplus materials. The Contractor shall leave the Work in condition for occupancy by the Owner such that no cleaning or other operations are required. Material cleared from the Project and deposited on adjacent property shall not be considered as having been disposed of satisfactorily. If the Contractor fails to keep the Project clean of waste materials or rubbish, fails to satisfactorily clean-up weekly or at the completion of the Work, the Owner may do so and the costs thereof may be deducted from any amounts due the Contractor.

7.23 Utilities, temporary facilities, and signs shall be provided as described in the Contract Documents. Absent a contrary direction in the Supplementary Conditions, the Contractor shall pay all bills for water, electricity, or other public utility service to the Project site.

7.24 The Contractor shall indemnify and hold the Owner, the Designer, the Designer's consultants, and their officers, agents, and employees harmless against all costs, damages, and expenses, including attorney's fees and costs of defense, arising out of claims by any separate contractor or by any Subcontractor, sub-subcontractor, or supplier engaged by or employed by the Contractor or employed by any of the Subcontractors claiming through him, including without limitation damages, losses, and expenses arising out of or relating to any inconvenience, delay, interference, or other action or non-action of the Contractor or the Contractor's Subcontractors on the Project.

The Contractor acknowledges that should the Contractor or any of the Contractor's Subcontractors be damaged by any breach of contract by any other separate prime contractor on the Project, the Contractor may invoke applicable dispute resolution procedures with said other separate prime contractor or bring a direct civil action against said other separate prime contractor. The Contractor hereby expressly agrees that neither the Owner nor its officers, agents, or employees shall have any liability of any kind or nature whatsoever to the Contractor, its Subcontractors, sub-subcontractors, or suppliers arising out of or relating to any breach, inconvenience, delay, interference, or other action or non-action by any other separate prime contractor. The Contractor covenants not to sue the Owner for any loss or damage caused by any breach, inconvenience, delay, interference, or other action or non-action by any other separate prime contractor, notwithstanding whatever rights at law the Contractor might have to bring a civil action against the Owner for any breach, inconvenience, delay, interference, or other action or non-action of any other separate prime contractor. The Contractor agrees to look exclusively to the other prime contractor for relief or remedy.

Nothing contained herein or appearing anywhere in the Contract Documents shall obligate or require the Owner to exercise any right or privilege, or to take any action or to refrain from taking any action under any contract it may have with any other prime contractor or party to the Project for the benefit of the Contractor or any Subcontractor, sub-Subcontractor, or supplier claiming through the Contractor.

7.25 Prior to completion of the Work and Final Payment of the Contract Price, excepting only those portions of the Work deemed accepted in accordance with the Contract Documents, the Contractor shall have charge and care of the Work, and shall take every precaution against injury or damage to any part due to the action of the elements or from any other cause, whether arising from the execution or from the non-execution of the Work. The Contractor shall as required by the Owner replace, rebuild, repair, restore, and make good all injury or damage to any portion of the Work occasioned by any of the above causes before Final Completion and shall bear the expenses thereof.

7.26 In the event that the Work, or any portion thereof, is suspended at any time pursuant to an order of the Owner, the Contractor shall obey all instructions of the Owner regarding storage of materials, drainage, protection of the Work, and erection of temporary structures during the suspension period.

7.27 The Project Expediter for the Project shall be responsible for the coordination of the Work of itself and any other separate contractors, both as to space and time. The Project Expediter shall coordinate the implementation of the Contract Construction Schedule, all construction activities and close-out of the Project, including but not limited to all testing, inspection, certifications, and approvals required by public agencies.

The Contractor and the Project Expediter shall each be required to notify the Designer and the Owner promptly of any event or condition which could affect the conduct or progress of the Work and shall cooperate fully with all other contractors on the Project site.

7.28 The Owner hereby delegates to the Project Expediter all of its duties to coordinate and to expedite the Work not expressly reserved to the Owner by other provisions of the Contract Documents.

7.29 All Work performed pursuant to the Contract Documents shall conform in all respects to the North Carolina State Building Code and all other state, local, and national codes in effect at the time of and applicable to this Work.

7.30 The Contractor shall provide for and maintain necessary safety measures and safety programs for the protection of all persons at the Project site, and shall comply at all times with the requirements of the most current edition of the CAGC Safety and Health Manual [or the AGC Accident Prevention Manual in Construction], or the equivalent requirements of the Contractor's safety program, and shall fully comply with all Federal, State, and local laws, rules, regulations, and building code requirements so as to prevent accidents or injuries to persons on or about the Project site. The Contractor shall clearly mark or post signs warning of existing hazards, and shall barricade excavations, elevator shafts, stairways, and similar hazards. The Contractor shall protect against damage or injury resulting from falling materials, and shall maintain all protective devices and signs throughout the progress of the Work.

7.31 The Contractor shall adhere to the rules, regulations, and interpretations of the North Carolina Department of Labor's Occupational Safety and Health Standards for the Construction Industry (29 CFR Part 1926 as adopted in 13 NCAC 07F.0201, including 29 CFR Part 1910 General Industry Safety and Health Standards applicable to construction) and N.C. Gen. Stat. §95-126 through 155 (Occupational Safety and Health) as well as all revisions and amendments to such standards or statutes as may occur throughout the performance of the Work.

7.32 Any land disturbing activity performed by the Contractor in connection with the Project shall comply with all erosion control measures set forth in the Contract Documents and any additional measures which may be required in order to ensure that the Project is in full compliance with the Sedimentation Pollution Control Act of 1973, as implemented by Title 15 North Carolina Administrative Code, Chapter 4, Sedimentation Control, Subchapters 4A, 4B and 4C, as amended (15 NCAC 4A, 4B, and 4C), and as may be revised or amended in the future. Upon receipt of notice that a land-disturbing activity is in violation of said Act, the Contractor shall be responsible for ensuring that all steps or actions necessary to bring the Project in compliance with said Act are promptly taken. The Contractor shall be responsible for all penalties assessed pursuant to N.C. Gen. Stat. 113A-64 with respect to its Work, and

shall indemnify and hold harmless the Owner from all costs and expenses, including attorney's fees and costs of defense arising out of or related to the enforcement of the Act against any party or person described in this Article.

7.33 Any mechanical or electrical work such as sleeves, inserts, chases, etc. located in the Work of the Contractor for general work shall be built in by that Contractor. On multiple prime projects, the mechanical and electrical contractors shall set all sleeves, inserts, and other devices built into the structure in cooperation and under the supervision of the Contractor for general work. The responsibility for exact location of such items shall be that of the mechanical, plumbing, or electrical prime contractor.

7.34 The Contractor shall be responsible for permanently fixed service facilities and systems in use during progress of the Work and shall strictly adhere to the following procedures:

a) Prior to acceptance of the Work by the Owner, the Contractor shall remove and replace any part of the permanent building systems damaged through use during construction.

b) Temporary filters shall be installed in each of the heating and air conditioning units, return air grilles, and other locations to prevent intrusion of dust, dirt, and debris during construction. Temporary filters shall be removed and replaced with new filters immediately prior to Substantial Completion.

c) Extra effort shall be maintained to keep the building clean and under no circumstances shall air systems be operated if finishing operations are creating dust in excess of what would be considered normal if the building were occupied.

d) When the permanent lighting system is used during construction, lamps shall be replaced and shall be new on the date of Substantial Completion.

ARTICLE 8. OWNER

8.1 The Owner shall issue communications and notices to the Contractor through the Designer to the extent contemplated by the Contract Documents.

8.2 In case of termination of the employment of the Designer, the Owner shall appoint as Designer a qualified person who shall have and assume all rights and duties held by the original Designer.

8.3 The Owner shall have the right to take possession of and use any portion of the Work notwithstanding the fact that the time for completion of such portion of the Work may not have expired, but such taking possession and use shall not be deemed an acceptance of any Work not completed in accordance with the Contract Documents.

8.4 A waiver on the part of the Owner of any breach of any part of the Contractor shall not be held to be a waiver of any other or subsequent breach.

8.5 The Owner shall pay all permanent acreage fees, governmental impact fees, and meter deposits for permanent utilities.

ARTICLE 9. CONSTRUCTION MANAGER

9.1 The Owner may employ one or more Construction Managers for the purpose of assisting the Owner, Designer, and Contractor in developing and administering budgets and cost controls, in evaluating constructability and value engineering proposals, in establishing and maintaining a critical path method (CPM) schedule, in coordinating and/or expediting the Work with other projects being constructed by the Owner or others adjacent or near the Work, or for such other purposes as the Owner may deem appropriate. From time to time the Owner may identify such Construction Managers(s) to the Contractor in writing identifying any tasks assigned to such Construction Managers(s).

ARTICLE 10. DESIGNER

10.1 The Designer is charged with the responsibility of interpretation of the Contract Documents. The Designer's decisions relating to aesthetic matters shall be final.

10.2 All Work completed under the Contract Documents shall be subject to review by the Designer. No Work is to be covered without the Designer's review or prior authorization. Any Work so covered without the Designer's review or prior authorization shall be uncovered at the Contractor's expense. The Contractor shall notify the Designer in writing at least twenty-four (24) hours in advance of covering any Work.

10.3 The Designer shall not be responsible for the construction means, methods, techniques, sequences, procedures, or the safety precautions and programs incident thereto, and shall not be responsible for the Contractor's failure to perform the Work in accordance with the Contract Documents, but shall be entitled to enforce any requirements in the Contract Documents specifying particular means, methods, techniques, sequences, or procedures.

10.4 The Designer shall be an Owner's representative during the construction period. The duties, responsibilities and authority of the Designer as the Owner's representative during construction are as set forth in the Contract Documents.

ARTICLE 11. TESTING AND SURVEYING

11.1 Laboratory and field tests to determine compliance of construction with the Contract Documents shall be made by the Owner or testing consultants employed by the Owner except those required elsewhere in the Contract Documents to be paid for by the Contractor. The costs and expenses of providing samples for and assistance in any testing shall be borne by the Contractor and are included in the Contract Price. Any Work in which untested materials are used without approval or written permission of the Designer shall be removed and replaced at the Contractor's expense. Work found to be unacceptable or unauthorized will not be paid for and, if directed by the Designer shall be removed and replaced at the Contractor's expense. Unless otherwise designated, tests in accordance with the cited standard methods of ASTM or other generally recognized or specifically authorized methods which are current on the date of advertisement for bids shall be made at the expense of the Owner; provided, however, in the event that after such testing any Work is found to be defective or does not meet the requirements of the Contract Documents, the costs of retesting such Work and the costs of inspection services shall be

paid by the Contractor. Samples shall be taken by a testing laboratory employed by the Owner. All materials being used are subject to inspection, tests, or rejection at any time prior to or during incorporation into the Work. Copies of all Owner test reports will be furnished to the Contractor at his written request. Copies of Contractor test reports shall be furnished to the Designer upon written request.

11.2 The Owner shall have the right to deduct the costs of additional testing as described in paragraph 11.1 from any money due the Contractor; or if no money is due the Contractor, the Owner shall have the right to recover these costs from the Contractor, from its sureties, or from both.

11.3 All layouts and surveying shall be accomplished by properly qualified personnel duly licensed in the State of North Carolina.

ARTICLE 12. SEPARATE CONTRACTS

12.1 It is expressly understood that the Owner may deploy the Owner's own employees or engage other separate prime contractors to perform Work as a part of the Project whose work will be performed simultaneously and sequentially with the performance of the Work by the Contractor. It shall be necessary for the Contractor to coordinate construction activities with such other contractors, particularly with respect to access to work areas, storage of materials, and use of elevators and other common facilities. The Contractor shall diligently and in good faith cooperate with the Owner, the Designer, and all other contractors with respect to such matters and shall regularly and faithfully attend any and all meetings called by the Owner or the Designer with respect to such matters. Any disputes between the Contractor and any other separate prime contractor with respect to such matters shall be resolved in accordance with the claim and dispute resolution procedures in the Agreement.

ARTICLE 13. CONTRACT TIME

13.1 Within fourteen (14) days after receipt of the Construction Agreement by the Contractor for signatures, the Project Expediter shall prepare and submit to the Designer and Owner for review and approval a preliminary progress schedule for the Work pursuant to the requirements stated in the Contract Documents.

13.2 Within fourteen (14) days after initial receipt of the Construction Agreement for signatures the Contractor shall submit to the Designer a Submittal Register listing all Submittals the Contractor is required to make or proposes to make under the Contract Documents, the dates on which the Contractor proposes to make such Submittals and the dates by which the Contractor reasonably requires a response from the Designer with respect to each Submittal. The dates submitted shall be incorporated into the Contract Construction Schedule as Completion Dates when they have been approved or modified by the Owner. The Designer shall not be required to review any Submittal from the Contractor until a Submittal Register acceptable to and approved by the Owner has been submitted by the Contractor.

13.3 Not later than thirty (30) days following execution and delivery of the Construction Agreement by Owner to Contractor, the Owner shall deliver to the Contractor a Notice to

Proceed. The Notice to Proceed shall state a commencement date on which it is expected that the Contractor will begin the Work to be performed under the Agreement. The Contract Time shall be measured from said specified commencement date. The commencement date stated in the Notice to Proceed shall not be earlier than three (3) days after the Notice to Proceed is served on the Contractor.

If, other than by mutual agreement, said specified commencement date is more than thirty (30) days after the date of execution and delivery of the Agreement from Owner to Contractor and the Contractor believes said delay justifies an increase in Contract Price and/or an extension of Contract Time, the Contractor may make a claim therefore as provided in Article 14 and/or Article 15.

No Work shall be done prior to the date specified in the Notice to Proceed.

A final Contract Construction Schedule shall be submitted for approval by the Contractor, Designer, and Owner no later than fourteen (14) days after Notice to Proceed. No payments shall be due the Contractor until this schedule is approved by all parties.

13.4 The Contract Construction Schedule is a Contract Document. The Contractor represents that the Contract Construction Schedule has been reviewed in detail, that the Contractor participated in its preparation, that all of the activities which impact, limit, or otherwise affect the time of completion of the Work are shown in the Contract Construction Schedule and that all of the activities of others which impact, limit, or otherwise affect the start, duration, or completion of the Contractor's activities are also shown. The Contractor further represents that the Contractor can and will complete each activity within the time shown for that activity. Time is of the essence with respect to each such activity and Completion Date.

13.5 If the Contractor submits a construction schedule, progress report, or any other document that indicates or otherwise expresses an intention to achieve completion of the Work prior to any Completion Date required by the Contract Documents or prior to expiration of the Contract Time, no liability of the Owner to the Contractor for any failure of the Contractor to so complete the Work shall be created or implied.

13.6 If the Contractor, for reasons beyond the Contractor's control, is delayed in beginning any activity, the Contractor shall, nevertheless, have the same number of days as is shown in the Contract Construction Schedule for the activity, and the affected activity and any succeeding activity that is dependent upon that activity shall be adjusted accordingly; provided that at any time the Owner, by means of a Change Order, may require the Contractor to work overtime, to increase labor forces or to take any necessary or appropriate action to decrease the time required for any activity, and the Contractor shall be entitled to an adjustment in the Contract Price computed in accordance with Article 15 of these General Conditions.

13.7 At any time, the Owner may order the Contractor, on seven (7) days written notice, to begin any activity earlier than the starting date shown on the Contract Construction Schedule.

13.8 Should the Contractor fail to start any activity on the start date shown in the Contract Construction Schedule or as it may have been adjusted in accordance with paragraphs 13.5 or 13.6 above, or become delayed, the Contractor shall, without being entitled to any

increase in the Contract Price or other compensation, work overtime, increase labor forces or take such other action as may be necessary or appropriate to complete the activity by the Completion Date shown on the Contract Construction Schedule, or as such Completion Date may have been adjusted.

13.9 The Designer and Owner or his Construction Consultant shall monitor progress of the Work at all times and the Contractor shall cooperate with such monitoring and provide any and all information with respect to the progress of the Work and scheduling as the Owner may reasonably require.

13.10 On a monthly basis, the Contractor shall revise the Contract Construction Schedule, showing any adjustments made in accordance with paragraphs 13.5 or 13.6, above, by any Change Order, the progress of the Work, and any days gained or days lost with respect to any activity, and shall furnish copies thereof to the Owner and Designer.

13.11 Should any monthly revision of any Contract Construction Schedule show that the Contractor is behind on any activity, the late completion of which could delay Substantial Completion of the Work, the Owner shall be entitled to withhold from the next Progress Payment due the Contractor an amount not exceeding the amount the Owner would be entitled to in Liquidated Damages, should Substantial Completion be delayed by the same number of days that the Contractor is currently behind schedule. If, subsequently, the Contractor's progress, as shown by any succeeding monthly revision to the Contract Construction Schedule, is such that the anticipated delay no longer exists, the Owner shall pay with the Progress Payment next due to the Contractor such amounts as have been withheld in accordance with this paragraph.

13.12 The Owner shall have the right to perform Work, hire and employ labor and craftsmen, rent equipment, subcontract with other parties, or do anything that the Owner deems necessary or appropriate to remedy or cure any delay by the Contractor in the progress of the Work. Such action by the Owner shall not, in any way, affect, void or limit any warranty, guaranty or other responsibility of the Contractor under the Contract Documents. Such action may be taken by the Owner only after three (3) days written notice to the Contractor. All costs incurred by the Owner in taking any such action shall be charged to the Contractor and deducted from any amounts remaining due under the Agreement.

13.13 The Contractor may be entitled to an extension of the Contract Time (but no increase in the Contract Sum) for delays arising from unforeseen causes beyond the control and without the fault or negligence of the Owner, the Contractor or the Contractor's Subcontractors as follows:

a) Labor disputes and strikes that directly impact the critical path activities of the Contract Construction Schedule;

b) Acts of God, tornado, fire, hurricane, blizzard, earthquake, typhoon, or flood that damage completed Work or stored materials.

c) Acts of the public enemy; acts of the State, Federal, or local government in their sovereign capacities.

d) Abnormal inclement weather as defined in Article 13.14.

13.14 On any day that the Contractor considers that the Project is delayed by adverse weather conditions, the Contractor shall identify in writing to the Designer and the Owner the adverse weather conditions affecting each activity, the specific nature of the activity affected, the number of hours lost, and the number of and identity (by responsibility or trade) of workers affected and shall obtain from the Designer written recognition of the delay. The time for performance of this Contract includes an allowance for a number of calendar days which may not be suitable for construction Work by reason of adverse weather. The Contract Time will be extended only if the number of calendar days of adverse weather recognized by the Designer exceeds the number of inclement weather days set forth below, and the Contractor demonstrates how this adverse weather impacts activities on the critical path of the Contract Construction Schedule.

Month	Number of Inclement Weather Days
January	10
February	10
March	10
April	9
May	10
June	9
July	11
August	10
September	8
October	7
November	8
December	9

13.15 If the Contractor believes that the progress of the Work has been adversely affected by adverse weather recognized by the Designer during a particular month, the Contractor shall submit a written request for extension of time to the Designer. Such a request for time extension of the Contract Time shall be submitted by the tenth (10th) day of the month following that month in which the adverse weather is encountered. The request shall include, but is not limited to, the following information:

a) Detailed description of weather's effect on scheduled activities and its net effect on the critical path of the Project, and

b) Weather records from the official weather station nearest the Project site and records of actual observation as contained in daily reports, correspondence, or other documentation.

13.16 The Contractor specifically recognizes that a delay by the Contractor in achieving any Completion Date can have the effect of delaying the Substantial Completion of the Project, that such delay in Substantial Completion of the Project will necessarily cause damages, losses, and expenses to the Owner, including, but not limited to and by way of illustration only, increased capitalized costs and interests for the Project, increased and extended Project overhead, Designer's and Consultant's fees, increased costs of construction, increased and extended operation costs of other facilities, and inefficiency and loss of

productivity, and that such damages, losses, and expenses may not be readily identifiable or ascertainable at the time they are incurred or at any time. Therefore, and in recognition of these factors and the likelihood that actual damages from his delay will not be readily ascertainable, the Contractor agrees to pay to the Owner, as Liquidated Damages and not as a penalty, the sum identified in the Supplemental Conditions hereto as the Liquidated Damages per Day, for each day by which the failure to meet any Completion Date shown in the Contract Construction Schedule, adjusted in accordance with this Article, delays the Substantial Completion of the Project.

13.17 The Contractor shall not be entitled to any adjustment in the Contract Price or other compensation from the Owner for any delay in the completion of or progress on the Work that is caused by a force majeure condition or is otherwise not caused by the sole and direct act or omission of the Owner and the Owner's employees or agents.

13.18 The sum for Liquidated Damages is the amount stipulated in the Supplementary General Conditions per day per Prime Contractor as Liquidated Damages reasonably estimated in advance to cover the losses to be incurred by the Owner by reason of failure of said Contractor(s) to complete the Work within the time specified, such time being in the essence of this contract and a material consideration thereof.

ARTICLE 14. CHANGES IN THE WORK

14.1 Without invalidating the Contract Documents, the Owner may, at any time, or from time to time order additions, deletions, or revisions in the Work. Said additions, deletions, or revisions shall be authorized only by written Change Orders, Construction Change Directives or Field Orders. Upon receipt of a Change Order, Construction Change Directive or Field Order, the Contractor shall proceed with the Work involved. All such Work shall be executed under the applicable conditions of the Contract Documents. If any change causes an increase or decrease in the Contract Price and/or an extension or shortening of the Contract Time, adjustments shall be made as provided in Article 14 and/or Article 15.

In order to expedite the Work and avoid or minimize delay in the Work that might affect the Contract Price or Contract Time, the Designer may issue a Change Order in the form of a Construction Change Directive which when signed by the Owner and Designer, directs the Contractor to proceed promptly with the Work involved. Any claim for an adjustment in Contract Price or Time, if not defined in the Construction Change Directive, shall be promptly made in writing in accordance with the procedures defined in Article 15.2.

14.2 The Designer may authorize minor changes or alterations in the Work not involving change in the Contract Price or in the Contract Time and not inconsistent with the overall intent of the Contract Documents. These may be accomplished by a Field Order. Such alterations shall not invalidate the Contract Documents nor release the surety. If the Contractor believes that any minor change or alteration authorized by the Designer entitles him to an increase in the Contract Price and/or an extension of Contract Time, he may make a claim therefore as provided in Article 14 and/or Article 15.

14.3 Except in an emergency endangering life or property, no change shall be made by the Contractor except upon prior written Change Order, Directive or Field Order authorizing such Change.

14.4 Increases in the Contract Price and/or extensions of the Contract Time for additional Work performed by the Contractor shall only be in accordance with a written Change Order signed by the Owner and Designer. The Contractor shall not be entitled to additional time or to additional compensation for any Work performed or material supplied which is claimed to have been authorized or settled by an "oral" change, or by a "constructive" or "implied" change, or by a course of conduct, or by any action or non-action by the Owner, Designer, or any other persons, or by any means whatsoever other than by a written Change Order for such Work or material signed by the Owner and the Designer.

14.5 Changes in the Work resulting from emergency shall not invalidate the Contract Documents nor release the surety.

14.6 Neither the Owner nor the Designer shall be responsible for verbal instructions which have not been confirmed in writing, and in no case shall such instructions be interpreted as permitting a departure from the Contract Documents unless such instruction is confirmed in writing and supported by a proper Change Order, Construction Change Directive or Field Order, whether or not the cost is affected.

14.7 The Owner, in its sole discretion, may require that the Contractor notify the Contractor's sureties of any changes affecting the general scope of the Work or change in the Contract Price, and that the amount of applicable bonds shall be adjusted accordingly. If this requirement is exercised, the Contractor shall furnish proof of such adjustment to the Designer and the Owner.

If this requirement is exercised, the Change Orders shall require written consent of the Contractor's surety. At the time of signing a Change Order, the Contractor shall be required to certify as follows:

> "I certify that all sureties have been notified that my contract has been altered by the amount of this Change Order, and that a copy of the approved Change Order will be mailed to all sureties upon its receipt by me."

If this requirement is exercised, no payment to the Contractor on account of any Change Order shall become due or payable until written evidence of the surety's consent to the Change Order has been furnished to the Designer and to the Owner, and the furnishing of such written consent is a condition precedent to such payment.

14.8 The Contractor shall support all requests for Change Orders with a detailed cost breakdown showing cost of materials, labor, equipment, transportation, other items, Contractor's overhead and profit, and total cost, in accordance with methods defined in this Article, and, if the request seeks an extension of the Contract Time, with a time-related diagram which demonstrates specifically why an increase in construction time is needed.

14.9 When a request for a Change Order involves a Subcontractor, the Contractor shall provide quotation from same on Subcontractor's letterhead. The Subcontractor's quote shall list materials, equipment, and labor separately, and show overhead and profit in the manner provided in paragraph 14.8.

ARTICLE 15. CHANGE OF THE CONTRACT PRICE

15.1 The Contract Price constitutes the total compensation payable to the Contractor for performing all Work under the Contract Documents. All duties, responsibilities, and obligations assigned to or undertaken by the Contractor shall be at his expense without change in the Contract Price. The Contract Price may only be changed by a Change Order.

15.2 Any claim for an adjustment in the Contract Price shall be in writing and written notice of any event, action, or non-action which may become the basis of a claim shall be delivered to the Owner and the Designer within three (3) days of the occurrence, or the beginning of the occurrence, of any such event, action or non-action giving rise to the claim. Such written notice is a condition precedent to the making of a claim, and such notice shall describe the basis of the potential claim with reasonable detail and clarity.

A claim shall be made in writing and shall be delivered to the Designer and the Owner no later than fourteen (14) days after such notice. The claim shall describe in detail the basis for the claim, with specific reference to any provisions of the Contract Documents, by paragraph, drawing number, or other specific identification, and shall state the amount claimed and how it is calculated. If the Contractor, at the time the claim is made, is unable to state the amount claimed with accuracy, the Contractor shall so state and provide the estimated amount and the basis on which the amount is to be calculated. At the earliest date practicable, but in no event more than thirty (30) days after Contractor's notice of claim, the Contractor shall supplement the claim with an accurate statement of the amount claimed and how it has been calculated. The Contractor shall provide, in writing, in support of the claim all such explanations, arguments, data, receipts, expert opinions, or other documents or information as the Contractor deems appropriate to be considered in support of the claim. A claim may properly be rejected by the Owner by reason of the Contractor's failure to submit adequate or accurate documentation or information, except that within seven (7) days after being given notice that the claim has been rejected on this basis, the Contractor may submit additional documentation or information. No claim for a change of the Contract Price shall be considered or granted (except solely at the discretion of the Owner) unless a claim is so made, nor shall the Contractor be entitled to any increase in the Contract Price unless the Contractor has given notice and made such a written claim within the times required. The Owner shall decide, after obtaining the advice of the Designer, whether an increase in Contract Price is warranted, and the amount of such increase shall be determined as provided in paragraph 15.4 through 15.5, below. Any change in the Contract Price resulting from any such claim shall be incorporated in a Change Order.

The Owner shall advise the Contractor of its decision with respect to the claim within fourteen (14) days of its receipt, or of the receipt of additional documentation or information if the absence of such has previously been the basis of rejection of the claim; provided, however, that if, in its sole discretion, the Owner deems that review or consideration of any part of the claim or any matter related thereto by its governing Board is necessary or appropriate, it shall so advise the Contractor and shall provide its decision to the Contractor within seven (7) days after such Board consideration, review or action. Any claim on which the Owner has not provided its decision to the Contractor within the applicable time period shall be deemed denied.

If the Contractor is not satisfied with the decision of the Owner, the Contractor may within seven (7) days of receipt of the Owner's decision initiate the mediation process as described in Appendix A to the General Conditions of the Contract for Construction.

15.3 In determining the amount of a Contract Price adjustment, the parties shall apply the following methods, as appropriate:

(A) Change in Work: The Owner and Contractor shall negotiate in good faith and attempt to agree upon the value of any change (extra or decrease) in Work prior to the issuance of a Change Order covering said Work. Such Change Order shall set forth the corresponding adjustment to the Contract Price. In the event the Owner and the Contractor are unable to agree, the Owner shall grant an equitable adjustment in the Contract Price.

(B) Emergency Work: In the event of emergency endangering life or property, the Contractor may be directed by the Designer to proceed on a time and material basis, whereupon the Contractor shall so proceed and keep accurately, in such form as may be required by the Designer, a correct account of costs together with all proper invoices, payrolls, and supporting data therefore.

15.4 Where the Contract Price is to be adjusted, the following limitations shall apply in determining the amount of adjustment:

(A) In the case of extra or emergency work, the Contract Price shall not be increased by more than the reasonable, actual, and documented net cost of the extra or emergency work plus ten percent (10%) of such net cost on Work performed by the Contractor and five percent (5%) thereof on any subcontracted Work for overhead and profit combined.

(B) In the case of a decrease in Work, the Contract Price shall not be decreased by less than the net cost of the deleted Work plus five percent (5%) of such direct net cost for profit and overhead.

The term 'net cost' as used herein shall include, as applicable, and shall be limited to, all direct labor, direct material, direct equipment, labor burden, sales taxes, shipping and handling charges, permits and fees, and insurance and bond premium adjustments, if any, attributable to the change. All other items of cost shall be considered as overhead and covered by the percentages allowed in sections A and B of this paragraph.

The Contractor shall provide worksheets or tabulations describing the method by which the direct net cost was calculated, and shall provide all data needed to support the calculation of the direct net cost, all in a form acceptable to the Owner.

15.5 Where the Contract Price is to be adjusted by negotiation, the Owner may authorize and designate the Designer to negotiate with the Contractor on behalf of the Owner; provided, however, any agreement reached between the Contractor and Designer shall be subject to approval by the Owner.

ARTICLE 16. UNFORESEEN CONDITIONS

16.1 Should the Contractor encounter unforeseen conditions at the Project site materially differing from those shown on the Drawings or indicated in the Specifications or differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in this Agreement, the Contractor shall immediately, and in no event more than three days later, give notice to the Owner of such conditions before they are disturbed. The Owner and the Designer shall thereupon promptly investigate the conditions and if they find that they materially differ from those shown on the Drawings or indicated in the Specifications, they shall at once make such changes in the Drawings and/or Specifications as they may find necessary. Any increase or decrease in the Contract Price resulting from such changes shall be adjusted in the manner provided herein for adjustments as to extra and/or additional Work and changes. However, neither the Owner nor the Designer shall be liable or responsible for additional work, costs, or changes to the Work that could have been reasonably determined from any reports, surveys, and analyses made available for the Contractor's review or that could have been discovered by the Contractor through the performance of its obligations pursuant to the Contract Documents.

ARTICLE 17. CORRECTION OF WORK BEFORE FINAL PAYMENT

17.1 The Owner has the authority to stop or suspend work, and the Designer has the authority to order Work removed or to order corrections of defective Work or Work not in compliance with the Contract Documents where such action may be necessary to ensure successful completion of the Work.

Any work, materials, fabricated items, or other parts of the Work which have been found by the Designer to be defective or not in accordance with the Contract Documents shall be condemned and shall be removed from the Project by the Contractor, and immediately replaced by new Work in accordance with the Contract Documents at no additional cost to the Owner. Work or property of the Owner or others damaged or destroyed by virtue of such condemned Work shall be made good at the expense of the Contractor.

Correction of condemned Work described above shall be commenced by the Contractor within twenty-four (24) hours after notice from the Designer or the Owner and shall be pursued to completion. Should the Contractor fail to proceed reasonably with the above-mentioned corrections, the Owner may, three (3) days after the notice specified in the preceding sentence, proceed with correction, paying the cost, including costs of uncovering such condemned Work, of such corrections from amounts due or to become due to the Contractor.

Condemned Work removed shall be the property of the Contractor and shall be removed from the Project by him within ten (10) days after notice to remove it, and if not then removed, thereafter may be disposed of by the Owner without compensation to the Contractor and the cost of such disposal shall be deducted from amounts due or to become due to the Contractor.

Should the cost of correction of the Work and, if applicable, disposal of the condemned Work by the Owner exceed amounts due or to become due the Contractor, then the Contractor and the Contractor's sureties shall be liable for and shall pay to the Owner the amount of such excess.

ARTICLE 18. CORRECTION OF WORK AFTER SUBSTANTIAL COMPLETION; WARRANTIES AND GUARANTIES

18.1 Neither the final certificate, Final Payment, occupation of the premises by the Owner, nor any provision of the Contract Documents, nor any other act or instrument of the Owner or the Designer shall relieve the Contractor from responsibility for negligence, defective material or workmanship, or failure to comply with the Contract Documents.

18.2 The Contractor shall, at the Contractor's sole cost and expense, make all necessary repairs, replacements, and corrections of any nature or description, interior or exterior, structural or non-structural, that shall become necessary by reason of defective workmanship or materials which appear within a period of one (1) year from the date of Substantial Completion; provided, however that notwithstanding the preceding, if any longer guarantee period is specified for any particular materials or workmanship under the Contract Documents, or under any subcontract, or in connection with any manufactured unit which is installed in the Project, or under the laws of the State of North Carolina, the longer guarantee period shall govern.

18.3 If, within any guarantee period, repairs or changes are required in connection with the Work, which are rendered necessary as the result of the use of materials, equipment, or workmanship which are inferior, defective, or not in accordance with the terms of the Contract Documents, the Contractor shall, promptly upon receipt of notice from the Designer and without expense to the Owner:

a) Completely repair or replace the Work so that it conforms to the Contract Documents;

b) Correct all defects therein;

c) Make good all damage which, in the opinion of the Designer, is the result of the use of materials, equipment, or workmanship which are inferior, defective, or not in accordance with the terms of the Contract Documents; and

d) Make good any Work or material, or any equipment or contents disturbed in fulfilling any such guarantee.

If, in fulfilling the requirements of the Contract Documents or of any guarantee embraced therein or required thereby, the Contractor disturbs any work, facility, premises, or construction belonging to the Owner, the Contractor shall restore such disturbed work to a condition satisfactory to the Owner, and shall guarantee such restored work to the same extent as if it were Work under the Contract Documents.

If the Contractor, after notice, fails to proceed promptly to comply with the terms of the guarantee, the Owner may have the defects corrected, and the Contractor and the

Contractor's sureties shall be liable for all expenses incurred. "Promptly" is defined as within twenty-four (24) hours for systems necessary to normal operation of the building and within seventy-two (72) hours for all other items. All special guarantees applicable to definite parts of the Work that may be shown in or required by Contract Documents shall be subject to the terms of this paragraph during the first year of the life of such special guarantee. Manufacturer's standard guarantees or warranties which do not comply with the time limit specified herein shall be extended by the Contractor automatically without further action on the part of the Owner or the Designer.

18.4 In the eleventh calendar month after the date of Substantial Completion, and at the request of the Owner, the Contractor, the Owner and the Designer shall make an inspection of the Work for the purpose of identifying defective workmanship and/or materials. If the Contractor, having been requested to do so by the Owner, fails to participate in such inspection, the Contractor shall be conclusively bound by any decision or ruling by the Designer as to any defective workmanship or material and as to the Contractor's responsibility for its repair or replacement.

ARTICLE 19. OWNER'S RIGHT TO DO WORK

19.1 If, during the progress of the Work or during any period of guarantee, the Contractor fails to prosecute the Work properly or to perform any provision of the Contract Documents, the Owner, after three (3) days written notice to the Contractor from the Designer, or from the Owner after Final Payment, may perform or have performed that portion of the Work and may deduct the cost thereof from any amounts due or to become due the Contractor. Notwithstanding any action by the Owner under this paragraph, all warranties and bonds given or to be given by the Contractor shall remain in effect or shall be given by the Contractor.

19.2 Should the cost of such action by the Owner exceed the amount due or to become due the Contractor, the Contractor and his sureties shall be liable for and shall pay to the Owner the amount of such excess.

ARTICLE 20. PARTIAL PAYMENTS

20.1 Within thirty (30) days after his initial receipt of the Construction Agreement for signatures, the Contractor shall submit to the Designer a Schedule of Values. The Schedule of Values shall indicate the value of the Work, including applicable overhead and profit, for each Division and section of the Project Specifications. The Designer and Owner shall be provided with the Contractor's estimate papers, Subcontractor agreements, supplier quotes, or other documents substantiating these values if so requested in writing by the Designer. The Contractor shall provide the requested documentation within seven (7) days after receipt of the Designer's written request. The Schedule of Values shall be subject to approval by the Owner, and if the Owner and the Contractor cannot agree upon the Schedule of Values, the Designer shall prepare it, and the Schedule of Values as prepared by the Designer shall be binding on the Owner and the Contractor. No Request for Payment shall be certified by the Designer until the Designer has issued approval of said Schedule of Values.

20.2 Not later than the fifth (5th) day of each calendar month the Contractor shall submit to the Designer a Request for Payment for Work done during the previous calendar month. The Request for Payment shall be in form of AIA Document G702 (latest edition) and shall show substantially the value of Work done (including the value of material delivered to the Project or stored by the Contractor at another site, subject to the conditions hereinafter set forth) during the previous calendar month, and shall sum up the financial status of the Work with the following information:

a) Total Contract Price, including any adjustment thereto made pursuant to the Contract Documents.

b) Value of Work completed and materials properly stored to date.

c) Less amount retained.

d) Less previous payments.

e) Current amount due.

f) Balance remaining.

The Contractor, upon request of the Designer, shall substantiate the request with invoices, vouchers, payrolls, or other evidence.

20.3 When payment is requested or made on an account of stored materials, such materials must be stored on the Owner's property at such places and in such a manner as may be designated by the Designer. However, in the sole discretion of the Owner, with permission in writing from the Designer and Owner and under such circumstances as may be determined by the Owner, such materials may be stored in a bonded warehouse. The location and conditions for storage of such materials away from the Owner's property in a bonded warehouse shall be within the sole discretion of the Owner. Requests for Payment on account of stored materials shall be accompanied by paid invoices, bills of sale, warehouse receipts, or other documentary evidence establishing Owner's title to such materials, evidence that the stored materials are insured against loss and damage, and such other documentation as required by the Designer. Responsibility for the quantity, quality, and condition of such stored materials, whether stored on the Owner's property or away from the Owner's property, shall remain with the Contractor regardless of ownership or title. No payment shall be made on account of materials stored in a bonded warehouse unless the Contractor has acquired written permission from the Designer for such storage of materials and has complied with all conditions set forth in such permission regarding such storage of materials in a bonded warehouse.

20.4 Any Request for Payment received by the Designer on or before the fifth (5th) of the calendar month shall be certified for payment or returned for re-submission to the Contractor on or before the fifteenth (15th) of the calendar month. The Designer's certification shall be for the amount which was requested or that which the Designer has decided was justly due, and shall state in writing to the Contractor and Owner the reasons for withholding payment of any or all of the amount requested.

20.5 The Designer may fail to certify all or part of any payment requested for any of the following reasons:

a) Defective Work not corrected.

b) Suits, actions, or claims of any character filed against the Contractor, or due to the operations of the Contractor, or information or notice that a suit, action, or claim will be filed or has been made.

c) Information or notice that a Subcontractor or a supplier has not received payment.

d) The balance unpaid of the Contract Price is insufficient to complete the Work in the judgment of the Designer or Owner.

e) Damage to the Owner or another contractor.

f) Inability of the Contractor to meet a Completion Date, including an anticipated failure to meet a Completion Date entitling the Owner to withhold anticipated Liquidated Damages in accordance with paragraphs 13.15 and 13.17 hereof.

g) Failure to furnish Submittal as required by the Contract Documents on a timely basis in accordance with the Submittal Register.

h) Such other reason as to the Designer may appear prudent, proper, or equitable.

When grounds for withholding certification have been corrected, the Designer shall so certify to the Owner and the Owner shall make any payment due with respect to such certification as a part of his next payment after such certification.

20.6 No certificate issued or progress payment made shall constitute an acceptance of the Work or any part thereof.

20.7 The amount certified by the Designer for payment shall be ninety percent (90%) of the value of Work completed and materials stored since the Designer's last certification as shown on the Request for Payment, less any amounts not certified in accordance with paragraph 20.4, and this amount shall be paid by the Owner on or before the last business day of the month, but payment shall not be past due until not paid within fifteen (15) days thereafter.

20.8 After certification by the Designer (by means of certification for payment of Requests for Payment or otherwise) that the Work is fifty percent (50%) complete, and the Contractor has provided to the Owner the written consent of its sureties to the cessation of further percentage retention, the amount certified for payment with respect to subsequent Requests for Payment may in the discretion of the Owner be one hundred percent (100%) of the value of Work completed and materials stored since the Designer's last certification as shown on the Request for Payment, less any amounts not certified in accordance with paragraph 20.4; provided, however, that the aggregate of periodic payments shall not exceed ninety-five percent (95%) of the Contract Price.

ARTICLE 21. FINAL PAYMENT

21.1 Final Payment shall not be due to the Contractor until Final Completion.

21.2 Upon Substantial Completion, the Designer shall prepare and submit to the Contractor a deficiency list identifying all portions of the Work which are known by the Designer at that time to be incomplete or defective. Within thirty (30) days of receipt of this deficiency list, the Contractor shall complete and correct all items on that list along with all other Work required to achieve Final Completion of the Work. At any time prior to completion of the period of warranty, the Designer may submit to the Contractor a supplemental deficiency list, in which case the Contractor shall complete or correct any and all new items identified on the Supplemental deficiency list within the time period stipulated in paragraph 18.3

21.3 The making and acceptance of Final Payment shall constitute a waiver of all claims by the Owner except:

a) Claims arising from unsettled liens or claims against the Contractor.

b) Defective Work or materials appearing after Final Payment.

c) Failure of the Contractor to perform the Work in accordance with the Contract Documents.

d) As conditioned in the Performance Bond.

e) Claims made prior to Final Payment which remain unsettled.

f) Amounts due arising under Articles 18 and 28.

g) Claims for recovery of overpayment based upon incorrect measurement, estimate, or certificate.

21.4 The making and acceptance of Final Payment shall constitute a waiver of all claims by the Contractor except those claims previously made in writing pursuant to paragraph 15.2 and not finally resolved.

21.5 The Designer shall not authorize Final Payment until all of the Work under the Contract Documents has been certified by the Designer as completed, proper and suitable for occupancy and use, and has been approved by all federal, state and local agencies having jurisdiction.

21.6 The final Request for Payment shall be identified on its face as such and shall be presented by the Contractor to the Designer within thirty (30) days of completion of the Work. Final payment of the retained amount due the Contractor shall be made by the Owner within thirty (30) days after the later of (i) full and Final Completion of all Work required by the Contract Documents, and certification of such Work in accordance with paragraph 20.4; (ii) submission of the affidavits of other documentation required by Article 22; (iii) submission by the Contractor of a Request for Payment identified on its face as final and including the Designer's certification.

ARTICLE 22. CONTRACTOR, SUBCONTRACTOR AND SUPPLIER AFFIDAVIT

22.1 The Final Payment due the Contractor on account of the Contract Documents shall not become due until the Contractor has furnished to the Owner through the Designer: (A) an affidavit by the Contractor signed, sworn, and notarized to the effect that all payments for materials, services, or for any other reason in connection with the Work or performance of the Contract Documents have been satisfied and that no claims or liens exist against the Contractor in connection with the same; (B) affidavits from each Subcontractor and supplier signed, sworn, and notarized to the effect that (i) each such Subcontractor or supplier has been paid in full by the Contractor for all Work performed and/or materials supplied by him in connection with the Project, and (ii) that all payments for materials, services, and for any other reason in connection with the subcontract or supply contract have been satisfied and that no claims or liens exist against the Subcontractor or supplier in connection therewith; and (C) the written consent of the Contractor's sureties to Final Payment. In the event that the Contractor cannot obtain an affidavit, as required above, from any Subcontractor or supplier, the Contractor shall state in the Contractor's affidavit that no claims or liens exist against such Subcontractor or supplier to the best of the Contractor's knowledge, and that if any appear afterwards, the Contractor shall save the Owner harmless for all costs and expenses, including attorneys fees, on account thereof.

ARTICLE 23. ASSIGNMENTS AND SUBCONTRACTS

23.1 The Contractor shall not assign any portion of this Agreement nor subcontract the Work in its entirety without the prior written consent of the Owner. Except as may be required under terms of the bonds required by the Contract Documents, no funds or sums of money due or to become due to the Contractor under the Contract Documents may be assigned.

ARTICLE 24. MEASUREMENTS

24.1 Before ordering material or doing Work which is dependent for proper size or installation upon coordination with building conditions, the Contractor shall verify all dimensions and shall be responsible for the correctness of same. No consideration will be given for any claim based on differences between the actual dimensions and those indicated in the Contract Documents. Any discrepancies between the Contract Documents and the existing conditions shall be referred to the Designer for adjustment before any Work affected thereby is begun.

ARTICLE 25. CONTRACTOR AND SUBCONTRACTOR RELATIONSHIPS

25.1 Within thirty (30) days after initial receipt of the Construction Agreement for signatures the Contractor shall submit to the Designer and Owner for acceptance a current list of the names of Subcontractors and such other persons and organizations (including those who are to furnish materials or equipment fabricated to a special design) proposed for any and all portions of the Work. The Contractor shall provide this list at this time even if the Contractor was required to submit a list of proposed Subcontractors with the Contractor's bid. The Designer shall promptly reply to the Contractor in writing stating whether or not

the Owner or the Designer, after due investigation, has objection to any such proposed person or entity or if it needs additional information to evaluate the persons on the list. Failure of the Designer to reply within ten (10) days after the Contractor has furnished all required information shall constitute notice of no objection.

The Contractor shall not contract with any such proposed person or entity to whom the Owner or the Designer has made reasonable objection. If the Designer or Owner has reasonable objection to any such proposed person or entity, the Contractor shall submit a substitute to whom the Owner and the Designer have no reasonable objection. The Contractor shall make no substitution for any Subcontractor, person, or entity previously allowed without first notifying the Designer and Owner in writing and no substitution may be made if the Owner or Designer makes a reasonable objection to such substitution.

25.2 The Contractor agrees that the terms of the Contract Documents, including all portions thereof, shall apply to all Subcontractors of the Contractor as if they were the Contractor, and that the Subcontractors of the Contractor shall, by means of their subcontracts, be bound by all the terms of the Contract Documents including, but not limited to, Article 26 of these General Conditions.

25.3 Payments to Subcontractors shall be made in accordance with the provisions of N.C. Gen. Stat. §143-134.1.

ARTICLE 26. USE OF PREMISES

26.1 The Contractor shall confine apparatus, the storage of materials, the operations of workers, and the disposal of material to limits indicated by law, ordinances, permits, and directions of the Designer, if any.

26.2 The Contractor shall not load or permit any part of the Work to be loaded with a weight that will endanger its safety, intended performance, or configuration.

26.3 The Contractor shall enforce all of the Designer's instructions, including, but not limited to, those regarding signs, advertisements, fires, and smoking.

ARTICLE 27. CUTTING, PATCHING AND FITTING

27.1 The Contractor shall do all cutting, fitting, and patching of the Work that may be required to make its several parts come together properly and fit it to receive or to be received by Work shown in or which can be reasonably implied from the Contract Documents.

ARTICLE 28. DISPUTE RESOLUTION

28.1 The laws of the State of North Carolina shall apply to the interpretation and enforcement of this Agreement. Any and all suits or actions to enforce, interpret, or seek damages with respect to any provision of, or the performance or nonperformance of, this Agreement shall be brought in the General Court of Justice of North Carolina sitting in Cabarrus County, North Carolina and it is agreed by the parties that no other court shall have jurisdiction or venue with respect to such suits or actions. Appendix A shall be a part of the Contract Documents.

Prior to initiating an action under this Article, any party to this Agreement shall initiate the mediation process as provided in Appendix A to these General Conditions of the Contract for Construction.

28.2 Any person or firm that expressly or impliedly agrees to perform labor or services or to provide material, supplies, equipment, work, performance or payment bonds, insurance or indemnification for the construction of the Project or the Work shall be deemed a party to this Agreement solely for the purpose of this Article 28. The Contractor, by means of its subcontracts, shall specifically require its Subcontractors to be bound by this Article.

ARTICLE 29. TAXES

29.1 The Contractor has included in the Contract Price and shall pay all taxes assessed by any authority on the Work or the labor and materials used therein. The Contractor shall maintain all tax records during the life of the Project and furnish the Owner with a complete listing of all taxes paid by taxing authority, invoice number, date, amount, etc. in a form acceptable to the Owner. The Contractor is required to maintain a file showing taxes paid on the Project for three (3) years after Final Payment or turn said documents over to the Owner for his files.

29.2 The following is a list of requirements to be followed by the Contractor in maintaining proper records and reporting the North Carolina Sales and Use Tax and Local Sales and Use Tax. The Contractor shall comply fully with the requirements outlined below, in order that the Owner may recover the amount of the tax permitted under the law.

a) It shall be the Contractor's responsibility to furnish the Owner documentary evidence showing the materials used and sales and use tax paid by the Contractor and each of his Subcontractors. Such evidence shall be transmitted to the Owner with each pay request irregardless of whether taxes were paid in that period.

b) The documentary evidence shall consist of a certified statement by the Contractor and each of the Contractor's Subcontractors individually, showing total purchases of materials from each separate vendor and total sales and use taxes paid to each vendor. Certified statements must show the invoice number, or numbers, covered, and inclusive dates of such invoices.

c) Materials used from Contractor's or Subcontractor's warehouse stock shall be shown in a certified statement at warehouse stock prices.

d) The Contractor shall not be required to certify the Subcontractor's statements.

ARTICLE 30. OPERATION OF OWNER'S FACILITIES

30.1 The Contractor agrees that all Work done under the Contract Documents shall be carried on in such a manner so as to ensure the regular and continuous operation of the adjoining or adjacent facilities. The Contractor further agrees that the sequence of operations under the Contract Documents shall be scheduled and carried out so as to ensure said regular and continuous operation. The Contractor shall not close any areas of construction until so authorized by the Designer. The Contractor shall control operations to assure the least

inconvenience to the public. Under all circumstances, safety shall be the most important consideration.

ARTICLE 31. THIRD PARTY BENEFICIARY CLAUSE

31.1 It is specifically agreed between the parties executing the Agreement that, with the specific exception set forth paragraph 7.24 hereof, and that exception only, the Contract Documents and the provisions therein are not intended to make the public, or any member thereof, a third-party beneficiary of the Agreement, or to authorize anyone not a party to the Contract Documents to maintain a suit for personal injuries or property damage pursuant to the terms of provisions of the Contract Documents.

ARTICLE 32. MEASUREMENT OF QUANTITIES

32.1 All Work completed under the Contract Documents shall be measured by the Contractor using United States customary units of measurement. The method of measurement and computations to be used in determination of quantities of material furnished and of Work performed under the Contract Documents shall be those methods set forth in the Contract Documents or, if not specifically set forth therein, the method generally recognized as conforming to good engineering practice.

ARTICLE 33. TERMINATION BY THE OWNER FOR CAUSE

33.1 If the Contractor fails to begin or complete the Work under the Contract Documents within the time specified, or fails to perform the Work with sufficient labor and equipment or with sufficient materials to insure the prompt completion of said Work, or shall perform the Work unsuitably or shall discontinue the prosecution of the Work for three (3) days, or if the Contractor shall become insolvent, be declared bankrupt, commit any act of bankruptcy or insolvency, allow any final judgment to stand against the Contractor or its affiliated companies unsatisfied for a period of forty-eight (48) hours, make an assignment for the benefit of creditors, or for any other cause whatsoever shall not carry on the Work in an acceptable manner, the Owner may give notice in writing to the Contractor and the Contractor's sureties of such delay, neglect, or default, specifying the same, and if the Contractor within a period of three (3) days after such notice shall not proceed in good faith and with reasonable speed to correct such delay, neglect, or default in accordance with such notice, the Owner shall have full power and authority, to the extent permitted by law, without violating the Contract Documents, to take the prosecution of the Work out of the hands of the Contractor, to appropriate or use any or all materials and equipment at the Project as may be suitable and acceptable, and may enter into an agreement for the completion of the Work or pursue such other methods as in the Owner's opinion shall be necessary or appropriate for the completion of the Work in an acceptable manner. All costs and charges incurred by the Owner in proceeding in accordance with the preceding sentence, including attorney's fees, and all costs incurred by the Owner in completing the Work shall be deducted from any money due or which becomes due the Contractor. If such costs and expenses incurred by the Owner shall be less than the sum which would have been payable under Contract Documents if it had been completed by the Contractor, then the Contractor shall be entitled to receive the difference, but if such costs and expenses shall exceed the sum which would have been payable under the Contract Documents, the

Contractor and the Contractor's surety shall be liable to the Owner for and shall pay to the Owner the amount of such excess.

ARTICLE 34. TERMINATION OR SUSPENSION BY THE OWNER FOR CONVENIENCE

34.1 The Owner may, without cause, order the Contractor to terminate, suspend, delay, or interrupt the Work in whole or in part for such period of time as the Owner may determine.

34.2 If the Contractor is subsequently ordered by the Owner to resume the Work, any cost or expenses to which the Contractor may be entitled by reason of the suspension, delay, or interruption shall be recovered by means of a Change Order in accordance with Articles 13 and 14 hereof and the Contract Construction Schedule shall be adjusted in accordance with Article 13 hereof.

34.3 The Owner shall terminate the Work or portion thereof by written notice when the Contractor is prevented from proceeding with the Work as a direct result of an executive order of the President with respect to the prosecution of war or in the interest of national defense.

34.4 In the event of termination by the Owner under this Article, the Contractor shall be entitled to receive the reasonable and documented direct costs incurred prior to termination, including the cost of materials purchased for the Work which purchases cannot be canceled or which material cannot reasonably be used by the Contractor on other work, and the cost of closing down the Project in a safe and efficient manner, plus ten percent (10%) thereof for overhead and profit, subject to the following conditions:

a) When the Contract is terminated before completion of all items of Work, payment shall be made for the actual number of units or items of Work completed at the applicable contract prices, or as mutually agreed for items of Work partially complete. If a mutual agreement cannot be reached, the Owner shall have the authority to make such equitable adjustment as it deems warranted and the Final Payment shall be made accordingly.

b) Reimbursement for organization of any Work and moving equipment to and from the job shall be considered when not otherwise provided for in the Contract Documents where the volume of completed Work is too small to compensate the Contractor for those expenses under unit prices. If a mutual agreement cannot be reached, the Owner will have the authority to make such equitable adjustments as it deems warranted and the Final Payment will be made accordingly.

c) Materials obtained by the Contractor for the Work that have been inspected and accepted by the Designer and that are not incorporated in the Work shall, at the request of the Contractor, be purchased from the Contractor at the Contractor's actual cost as shown by receipted bills and actual costs records at such points of delivery as may be determined by the Owner.

d) No payment shall be made by Owner to Contractor except as herein above provided. No claim for loss of anticipated profits shall be considered or allowed.

e) Termination of the Contract shall not relieve the Contractor of his responsibilities for any completed portion of the Work nor shall it relieve his sureties of their obligation for and concerning any just claims arising out of the Work performed.

The Contractor shall not be entitled to any other compensation, including compensation for lost profit, lost opportunity, or any other direct or consequential cost, loss, or damage.

ARTICLE 35. MINORITY BUSINESS ENTERPRISE PROGRAM

35.1 The Contractor shall at all times comply with the latest edition of the Cabarrus County Minority Business Enterprise Policy. All documentation substantiating compliance with the requirements of this program shall be delivered to the Owner as stipulated in the Contract Documents.

ARTICLE 36. GENERAL

36.1 If any provision of the Agreement shall be declared invalid or unenforceable, the remainder of the Agreement shall continue in full force and effect.

36.2 The titles to Articles herein are for convenience only, are not substantive parts of the General Conditions, and are not to be considered in interpreting the Contract Documents.

END OF GENERAL CONDITIONS OF THE
CONTRACT FOR CONSTRUCTION

SECTION 00800

SUPPLEMENTARY GENERAL CONDITIONS

GENERAL

These Supplementary Conditions contain changes and additions to the project "GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION", as published herein. Where any Article of the General Conditions is modified or any Paragraph, Subparagraph or Clause thereof is modified or deleted by these Supplementary Conditions, the unaltered provisions of the Article, Paragraph, Subparagraph or Clause shall remain in effect.

ARTICLE 1. DEFINITIONS

Paragraph 1.18: Delete the last sentence in its entirety and substitute the following in lieu thereof:

"A list of the Drawings is contained in Section 00850."

Paragraph 1.40: In paragraph 1.40, the definition for "Substantial Completion", modify the last sentence as follows:

"...Owner training, certified surveys per Section 01050, and as-built..."

ARTICLE 3. FAMILIARITY WITH WORK, CONDITIONS AND LAWS

Add the following paragraphs:

"3.5 A Pre-Bid Conference will be held at the location, date, and time indicated in Section 00020. Purpose of conference is for prospective Bidders to familiarize themselves with the site and to ask questions pertaining to the Contract Documents. Bidders are reminded that no oral interpretations of meaning of Drawings and Specifications can be made. Conflicts in documents, if any, will be resolved by written addendum.

3.6 If all lands and rights of way are not obtained as herein contemplated before construction begins, Contractor shall begin the Work upon such land and rights of way as Owner has previously acquired.

3.7 Engineer may check line and grades, elevations, reference marks, etc., set by Contractor, and Contractor shall correct any errors disclosed by such check. Such a check shall not be considered an approval of the Contractor's work and shall not relieve the Contractor of the responsibility for accurate construction of the entire Work. Contractor shall furnish personnel to assist Engineer in checking lines and grades."

ARTICLE 7. CONTRACTOR

Add three new paragraphs to Article 7 of the General Conditions which are to read as follows:

"7.35 Regular working hours are defined as 10 hours per day, Monday through Saturday, excluding holidays, between the hours of 7:00 AM and 7:00 PM. Requests to work other

than regular working hours shall be submitted to the Engineer not less than 48 hours prior to any proposed additional daily working hours, Sunday work or scheduled extended work weeks. All requests to work other than regular working hours must comply with all applicable regulation and ordinances. Requests will be reviewed by the Owner and Engineer and the Engineer will either: (1) deny request or (2) provide Contractor with terms for additional engineering and/or inspection costs to be paid for by the Contractor as a result of overtime work in excess of the regular working hours. Contractor shall agree to Engineer's terms prior to Engineer approving Contractor's request to work other than regular working hours.

7.36 Contractor shall reimburse the Owner for additional engineering and/or inspection costs incurred as a result of overtime work in excess of the regular working hours stipulated in Article SC 7.35. At Owner's option, overtime costs may either be deducted from the Contractor's monthly payment request or deducted from the Contractor's retention prior to release of final payment. Overtime costs for personnel employed by the Engineer or Owner shall be as follows:

Resident Project Representative	$ 95 per hour
Senior Construction Manager	$140 per hour

7.37 Reimbursement of Engineering Cost: The Owner's budget for the Engineer for the work of this Contract is based on the routine duties of the Engineer as generally indicated in the Specifications. Certain actions or lack of actions on the part of the Contractor may necessitate additional effort on the part of the Engineer and, hence, Owner costs for Engineering above and beyond the costs for routine Engineering services. The Contractor shall pay to the Owner the reasonable costs of such additional Engineering effort, which shall include the following:

1. Review of shop drawings or working drawings beyond the second submittal.

2. Actions related to Contractor requests for deviations or substitutions from the Contract requirements for the Contractor's benefit or preference.

3. Inspections, investigations, research, and communications relating to construction deviations, errors, or contravention of Contract requirements.

4. Inspections of suppliers where deviations from the approved shop drawings or Contract requirements are found to be taking place or to have taken place.

5. Any other circumstance where the Contractor's action or lack of action results in unnecessary additional Engineering costs to the Owner.

The Engineer or Owner will notify the Contractor in writing when one of the above circumstances exists for which reimbursement of Engineering costs is required. The Engineer or Owner will be the sole judge of when such circumstances exist and the level of effort involved.

The standard reimbursement rate shall be $120 per hour of Engineering time plus and travel costs involved. The amount shall be incorporated into a Contract Change Order or otherwise deducted from payment due the Contractor."

ARTICLE 10. DESIGNER

Add the following paragraphs:

"10.5 As a part of its Basic Services under the Owner-Engineer Agreement, the Engineer will conduct a single site visit to determine Substantial Completion of the Work. If, after the performance of said site visit, the Engineer determines that the Work is not substantially complete, successive site visits to determine Substantial Completion will be deemed Additional Services under the Owner- Engineer Agreement. The Contractor shall be liable to the Owner for any Engineer's fees incurred as a result of any such Additional Services of the Engineer. Any funds due under this paragraph may be deducted by the Owner from the amounts due the Contractor for such additional Engineer's fees and paid directly to the Engineer. Should the cost for such Additional Services of the Engineer exceed the amount due or to become due to the Contractor, then the Contractor and his sureties shall be liable for and shall pay to the Owner the amount of any such excess.

10.6 As a part of its Basic Services under the Owner- Engineer Agreement, the Engineer will conduct a single site visit to determine Final Completion of the Work. If, after the performance of said site visit, the Engineer determines that the Work is not complete, successive site visits to determine Final Completion of the Work will be deemed Additional Services under the Owner- Engineer Agreement. The Contractor shall be liable to the Owner for any Engineer's fees incurred as a result of any such Additional Services of the Engineer. Any funds due under this paragraph may be deducted by the Owner from the amounts due the Contractor for such additional Engineer's fees and paid directly to the Engineer. Should the cost for such Additional Services of the Engineer exceed the amount due or to become due to the Contractor, then the Contractor and his sureties shall be liable for and shall pay to the Owner the amount of any such excess.

10.7 Engineer will furnish a Resident Project Representative (RPR) to observe and document the performance of the Work. RPR services may not require full-time onsite representation. The Contractor shall notify the RPR in writing at least forty-eight (48) hours in advance of covering any Work. This replaces the twenty-four (24) notice referenced in Paragraph 10.2 under Section 00700."

ARTICLE 13. CONTRACT TIME

Paragraph 13.15: At the end of the existing paragraph, add the following new paragraph:

"Weather days will not be granted to the Contractor for weekend work outside the regular working hours not approved by the Engineer, including Sundays and holidays."

Paragraph 13.18: Add the following:

If the Contractor fails to achieve Substantial Completion of the Work within the Contract Time and as otherwise required by the Contract Documents, the Owner shall be entitled to retain or recover from the Contractor, as Step One Liquidated Damages and not as a penalty, the following per diem amount commencing upon the first day following expiration of the Contract Time and continuing until the actual date of Substantial Completion. Such liquidated damages are hereby agreed to be a reasonable pre-estimate of damages the Owner will incur as a result of delayed Substantial Completion of the Work:

One Thousand Dollars ($1,000.00) per consecutive calendar day

If the Contractor fails to achieve Final Completion of the Work within thirty (30) consecutive calendar days of the actual date of Substantial Completion of the Work, the Owner shall be entitled to retain or recover from the Contractor, as Step Two Liquidated Damages and not as a penalty, the following per diem amount commencing upon the first day following the actual date of Substantial Completion and continuing until the actual date of Final Completion. Such liquidated damages are hereby agreed to be a reasonable pre-estimate of damages the Owner will incur as a result of delayed Final Completion of the Work:

One Thousand Dollars ($1,000.00) per consecutive calendar day

The Owner may deduct liquidated damages described above from any unpaid amounts then or thereafter due the Contractor under this Agreement. Should the amount of any liquidated damages exceed the amount due or to become due to the Contractor, then the Contractor and his sureties shall be liable for and shall pay to the Owner the amount of any such excess."

ARTICLE 14. CHANGES IN THE WORK

Add a new paragraph to Article 14 of the General Conditions which are to read as follows:

"14.10 The adjustment in the Contract Price and/or Contract Time stated in the Change Order shall comprise the total price and/or time adjustment due or owed the Contractor for the work or changes defined in the Change Order. By executing the Change Order, the Contractor acknowledges and agrees that the stipulated price and/or time adjustments include the costs and delays for all work contained in the Change Order, including costs and delays associated with the interruption of schedules, extended overheads, delay, and cumulative impacts or ripple effect on all other non-affected work under this contract. Signing of the change order constitutes full and mutual accord and satisfaction for the adjustment in contract price or time as a result of increases or decreases in costs and time of performance caused directly and indirectly from the change, subject to the current scope of the entire work as set forth in the Contract Documents. Acceptance of this waiver constitutes an agreement between Owner and Contractor that the Change Order represents an equitable adjustment to the Contract, and that Contractor will waive all rights to file a claim on this change order after it is properly executed."

ARTICLE 15. CHANGE OF THE CONTRACT PRICE

Add a new paragraph immediately after Paragraph 15.4(B) of the General Conditions which are to read as follows:

"(C) The unit price of an item of Unit Price Work shall be subject to re evaluation and adjustment under the following conditions:

C.1 if the total cost of a particular item of Unit Price Work amounts to 5 percent or more of the Contract Price and the variation in the quantity of that particular item of Unit Price Work performed by Contractor differs by more than 25 percent from the estimated quantity of such item indicated in the Agreement; and

C.2 if there is no corresponding adjustment with respect to any other item of Work; and

C.3 if Contractor believes that Contractor has incurred additional expense as a result thereof; or if Owner believes that the quantity variation entitles Owner to an adjustment in the unit price, either Owner or Contractor may make a claim for an adjustment in the Contract Price in accordance with Article 15 if the parties are unable to agree as to the effect of any such variations in the quantity of Unit Price Work performed."

ARTICLE 20. PARTIAL PAYMENT

Add a new paragraph to Article 20 of the General Conditions which are to read as follows:

"20.9 Payment on unit price items shall be limited to a maximum of 95% of actual in-place work without a certified survey, as required per Section 01025. The certified survey shall be approved by the Engineer prior to approval for payment in excess of 95%."

ARTICLE 29. TAXES

Paragraph 29.1: Add the following to the existing paragraph:

"The Contractor is to use the Sales Tax Reporting Form attached to the contract documents for reporting taxes paid."

ARTICLE 36. GENERAL

Add the following paragraphs:

"36.3 Any specific requirement in this Contract that the responsibilities or obligations of the Contractor also apply to a Subcontractor is added for emphasis and is also hereby deemed to include a Subcontractor of any tier. The omission of a reference to a Subcontractor in connection with any of the Contractor's responsibilities or obligations shall not be construed to diminish, abrogate, or limit any responsibilities or obligations of a Subcontractor of any tier under the Contract Documents or the applicable subcontract.

36.4 The form of all submittals, notices, change orders, and other documents permitted or required to be used or transmitted under the Contract Documents shall be determined by Engineer. Standard forms which Engineer expects to use are contained in the subsequent pages of these Supplementary Conditions.

35.5 Estimated quantities are given in the Bid Form for the purpose of comparing unit prices bids, and while the quantities are believed to be close approximations, payment will be calculated on the basis of the actual work executed at the unit prices in the Bid Form as determined by the Method of Measurement. The Owner reserves the right to increase and/or decrease any or all of the quantities as listed in the Proposal at the same unit price or prices as listed in the Proposal. The Owner further reserves the right to delete any singular item or any combination of items from the successful bidder's proposal."

END OF SUPPLEMENTARY GENERAL CONDITIONS

FINAL RECEIPT

Contract: _____

Received this _____ day of _____ A.D., 20___ of _____ as full and final payment of the cost of all improvements provided for in the foregoing contract the sum of _____ Dollars and _____Cents, ($_____), in cash, being the full amount accruing to the undersigned by virtue of said Contract, said cash covering and including full payment for all extra work and material furnished by the undersigned in the construction of said improvements, and all incidentals thereto, and the undersigned hereby releases the said _____ from all claims whatsoever growing out of the said Contract.

These presents are to certify that all persons doing work upon or furnishing materials or supplies for said improvements under the foregoing Contract have been paid in full.

The undersigned further certifies that all taxes imposed by Chapter 212, North Carolina Statues (Sales and Use Tax Act), as amended, have been paid and discharged.

_____
CONTRACTOR

By: _____ (Seal)

_____
(Typewritten Name)

FIELD ORDER

FIELD ORDER NO.:_____ Date: _____

PROJECT:_____

RE:_____

_____

TO CONTRACTOR: This Field Order is issued to interpret/clarify the Contract Documents, order minor changes in the work, and/or memorialize trade-off agreements. Both parties hereby agree that the work described by this Field Order is to be accomplished without change in Contract Price, Contract Time, and/or claims with other costs.

DESCRIPTION:_____

_____

_____

_____

_____

ATTACHMENTS:_____

_____

REFERENCES:_____

_____

CAMP DRESSER & McKEE

By:_____

Date:_____

cc:_____

_____

CONTRACTOR:

By:_____

Date:_____

WORK CHANGE DIRECTIVE

No._____

PROJECT_____

Date of Issuance_____ Effective Date_____

Owner _____ Owner's Contract No._____

Contractor_____ Engineer_____

You are directed to proceed promptly with the following change(s):

Description:_____

_____

Purpose of Work Change Directive:_____

_____

Attachments (List documents supporting change):_____

_____

If a claim is made that the above change(s) have affected Contract Price or Contract Times, any claim for a Change Order based thereon will involve one or more of the following methods of determining the effect of the change(s).

Method of determining change in Contract Price:

Unit Prices ( )

Lump Sum

Other _____

Estimated (increase/decrease) in Contract Price:

$_____

If the change involves an increase, the estimated amount is not to be exceeded without further authorization.

Method of determining change in Contract Times:

Contractor's records

Engineer's records

Other _____

Estimated (increase/decrease) in Contract Times:

Substantial Completion: _____ days;

Ready for final payment: _____ days;

If the change involves an increase, the estimated times are not to be exceeded without further authorization.

RECOMMENDED:

_____

Engineer

By:_____

(Authorized Signature)

AUTHORIZED:

_____

Owner

By:_____

(Authorized Signature)

WORK CHANGE DIRECTIVE

INSTRUCTIONS

A. GENERAL INFORMATION

This document was developed for use in situations involving changes in the Work which, if not processed expeditiously, might delay the Project. These changes are often initiated in the field and may affect the Contract Price or the Contract times. This is not a Change Order, but only a directive to proceed with Work that may be included in a subsequent Change Order.

For supplemental instructions and minor changes not involving a possible change in the Contract Price or the Contract Times a Field Order may be used.

B. COMPLETING THE WORK CHANGE DIRECTIVE FORM

Engineer initiates the form, including a description of the items involved and attachments.

Based on conversations between Engineer and Contractor, Engineer completes the following:

METHOD OF DETERMINING CHANGE, IF ANY, IN CONTRACT PRICE: Mark the method to be used in determining the final cost of Work involved and the estimated net effect on the Contract Price. If the change involves an increase in the Contract Price and the estimated amount is approached before the additional or changed Work is completed, another Work Change Directive must be issued to change the estimated price or Contractor may stop the changed Work when the estimated price is reached. If the Work Change Directive is not likely to change the Contract Price, the space for estimated increase (decrease) should be marked "Not Applicable."

METHOD OF DETERMINING CHANGE, IF ANY, IN CONTRACT TIMES: Mark the method to be used in determining the change in Contract times and the estimated increase or decrease in Contract Times. If the changes involves an increase in the Contract Times and the estimated times are approached before the additional or changed Work is completed, another Work Change Directive must be issued to change the times or Contractor may stop the changed Work when the estimated times are reached. If the Work Change Directive is not likely to change the Contract Times, the space for estimated increase (decrease) should be marked "Not Applicable."

Once Engineer has completed and signed the form, all copies should be sent to Owner for authorization because Engineer alone does not have authority to authorize changes in Price or Times. Once authorized by Owner, a copy should be sent by Engineer to Contractor. Price and times may only be changed by Change Order signed by OWNER and CONTRACTOR with ENGINEER'S recommendations.

Once the Work covered by this directive is completed or final cost and times are determined. Contractor should submit documentation for inclusion in a Change Order.

THIS IS A DIRECTIVE TO PROCEED WITH A CHANGE THAT MAY AFFECT THE CONTRACT PRICE OR THE CONTRACT TIMES. A CHANGE ORDER, IF ANY, SHOULD BE CONSIDERED PROMPTLY.

CHANGE ORDER NO. _____

PROJECT:_____

Date of Issuance:_____ Effective Date:_____

OWNER:_____ OWNER's Contract No.:_____

CONTRACTOR:_____ ENGINEER:_____

CONTRACTOR is directed to make the following changes in the Contract Documents.

Description:_____

_____

Attachments:_____

_____

CHANGE IN CONTRACT PRICE:	CHANGE IN CONTRACT TIMES:
Original Contract Price $	Original Contract Times Substantial Completion: Ready for final payment: days or dates
Net changes from previous Change Orders No. ___ to No. $	Net change from previous Change Orders No. to No. days
Contract Price prior to this Change Order $	Contract Times prior to this Change Order Substantial Completion: Ready for final payment: days or dates
Net Increase (decrease) of this Change Order $	Net Increase (decrease) of this Change Order Days
Contract Price with all approved Change Orders $	Contract Times with all approved Change Orders Substantial Completion: Ready for final payment: _____ days or dates

RECOMMENDED:	APPROVED:	ACCEPTED:
By:_____	By:_____	By:_____
Engineer (Authorized Signature)	Owner (Authorized Signature)	Contractor (Authorized Signature)
Date:_____	Date:_____	Date:_____

IN WITNESS WHEREOF, we have hereunto caused the execution of these premises.

_____
{Company Name}

CORPORATE SEAL

_____
{City, State}

By:_____
Signature Title

Date:_____ _____
Witness Signature

ATTEST/WITNESS:

_____ _____
Secretary of Corporation Witness Signature

OWNER:_____ ATTEST:_____

Date:_____

APPROVED AS TO FORM AND LEGAL SUFFICIENCY:

By:_____ Date:_____

ATTACHMENT "A"

CHANGE ORDER NO. _____

SUPPORTING DOCUMENTATION

Change Order Item No.	Description

CHANGE ORDER

INSTRUCTIONS

A. GENERAL INFORMATION

This document was developed to provide a uniform format for handling Contract changes that affect Contract Price or Contract Times. Changes that have been initiated by a Work Change Directive must be incorporated into a subsequent Change Order if they affect Contract Price or Times.

Changes that affect Contract Price or Contract Times should be promptly covered by a Change Order. The practice of a cumulating change order items to reduce the adminstrative burden may lead to unnecessary disputes.

If Milestones have been listed any effect of a Change Order thereon should be addressed.

For supplemental instructions and minor changes not involving a change in the Contract Price or Contract Times, a Field Order may be used.

B. COMPLETING THE CHANGE ORDER FORM

Engineer initiates the form, including a description of the changes involved and attachments based upon Documents and proposals submitted by Contractor, or requests from Owner, or both.

Once Engineer has completed and signed the form, all copies should be sent to Contractor for approval. After approval, by Contractor, all copies should be sent to Owner for approval. Engineer should be make distribution of executed copies after approval by Owner.

If a change only applies to Contract Price or to Contract Times, cross out the part of the tabulation that does not apply.

CONTRACTOR'S RELEASE OF OWNER

The Contractor, known as _____,

for the construction of _____,

hereby and forever releases the Owner, known as _____,

its officers, agents, and engineers, Camp Dresser & McKee, from all past, present, and future claims and liability to the Contractor for anything done or furnished for, relating to, or for any act of neglect of the Owner, its engineers, or any persons relating to or affecting the work.

Contractor's Certification:

Contractor: _____

Authorized Representative: _____

Date: _____

CONSENT OF SURETY COMPANY TO FINAL PAYMENT

PROJECT:_____

OWNER:_____

CONTRACTOR:_____

CONTRACT DATE:_____

TO: _____

_____

_____

_____

In accordance with the provisions of the Contract between the Owner, known as _____ _____, and the Contractor, known as _____ _____, the Surety Company, known as _____ _____, on bond of Contractor, hereby approves of the final payment to Contractor, and agrees that final payment to Contractor shall not relieve the Surety Company of any of its obligations to the Owner as set forth in said Surety Company's bond.

In witness whereof, the Surety Company has hereunto set its hand this _____ day of _____ in the year _____.

_____
Surety Company

_____
Signature of Authorized Representative

(Seal)

_____
Typed Name and Title of Authorized Representative

SECTION 00810

CONTRACTOR'S SALES TAX REPORT
N.C. STATE & LOCAL SALES TAXES PAID

OWNER:_____ PROJECT:_____

CONTRACTOR:_____ FOR PERIOD:_____

ADDRESS:_____ TO:_____

VENDOR	*MATERIAL PURCHASE*	*ADDRESS*	*INVOICE NUMBER*	*DATE*	*INVOICE AMOUNT*	*N.C. TAX*	*COUNTY TAX*	*NAME OF COUNTY*

TOTAL _____

I hereby certify that for the period stated above, North Carolina sales and use taxes were paid as listed above, with respect to building materials, supplies, fixtures, and equipment which have become a part of or annexed to, a building or structure erected, altered or repaired for the County of Cabarrus, and that the vendors from whom the property was purchased, the dates and numbers of the invoices covering the purchases, the total amount of the invoices of each vendor, the North Carolina sales and use taxes paid thereon, and the cost of property withdrawn from warehouse stock and North Carolina sales or use taxes paid thereon are as set forth above.

Sworn to and Subscribed before me, this _____ day of _____, 20__. By:_____

_____ Notary Title:_____

My Commission Expires_____

SECTION 00900

PROJECT ADDENDA

The following addenda have been issued by the Engineer and shall be made part of the Bidding and Contract Documents:

END OF SECTION

SECTION 01010

SUMMARY OF WORK

PART 1: GENERAL

1.01 DESCRIPTION OF WORK

A. The Work to be performed under this Contract generally includes the construction of a 2.1 acre double-lined cell area. Work is to include the installation of a 40-mil HDPE base liner, geocomposite drainage net, a 10-inch secondary soil drainage layer and 24-inch protective soil drainage layer. Protective cover and secondary drainage layer material shall be obtained from an offsite borrow source with a specified permeability of 5×10^{-5} cm/sec or greater. Work shall include stripping existing vegetation, preparing the liner subgrade and liner installation, as well as a leachate collection system with force main, erosion control measures, seeding and mulching and other incidentals as shown on the Drawings and as noted in the Specifications. The Owner's onsite borrow area will be available for liner subgrade preparation and miscellaneous soil needs. Sorting and processing of the onsite borrow soil may be needed. Work may also include the construction of a 1-acre Subcell A area within the lined expansion. This will depend on the need for permitted airspace for waste disposal prior to overall project completion. Days will be added to the date of Substantial Completion if this option is selected. In addition, work will also include the construction of a leachate tank truck loading area. A 150,000 gallon leachate storage tank system (including secondary containment, piping, transfer pump, etc.) shall be included as a bid alternate.

1.02 WORK TO BE DONE

A. Provide all labor, materials, equipment, tools, services and incidentals necessary to complete all work required by the Contract Documents to furnish and install all work as shown on the Drawings and specified herein.

B. Complete the Work, in place, tested, and ready for continuous service. Perform or provide repairs, replacements and restoration required as a result of damages resulting from construction operations.

C. Furnish and install all materials, equipment, and incidentals which are reasonably and properly inferable and necessary for the proper completion of the Work, whether specifically indicated in the Contract Documents or not.

1.03 WORK SEQUENCE

A. Perform Work in proper sequence to ensure completion of the Work within the Contract Time and as required by Sections 00500, 01041 and 01310. The completion date shall be in accordance with the concurred construction schedule submitted by the Contractor.

B. SUBSTANTIAL COMPLETION: To satisfy the definition of Substantial Completion, the facilities shall be constructed, complete, field tested and fully operational including Owner training, subject to the Engineer's approval except for Deficiencies and Omissions noted by Owner and Engineer.

C. READY FOR FINAL PAYMENT: The last stage of construction shall be final construction and shall include the final remaining items subject to the Engineer's approval as well as all items listed in Section 01700, Contract Closeout.

1.04 DRAWINGS AND SPECIFICATIONS FURNISHED TO THE CONTRACTOR FOR CONSTRUCTION

A. Three sets of blackline prints and three sets of Specifications shall be furnished to the Contractor for construction at no charge. Additional sets may be purchased at the cost of reproduction.

1.05.1 PROJECT SUBMITTALS

A. In accordance with the Contract Documents, the Contractor shall be responsible for submitting a variety of documents, schedules and shop drawings. A list of early submittal and notification requirements and the associated Specification Sections is provided below. This list is not to be construed to include all submittals or notifications required, but is intended as a reminder of documentation required.

1. 01041 Paragraph 1.12(A) – Submit Hurricane Preparedness Plan within fifteen (15) days of the date of NTP.

2. 00700 Paragraph 2.05 - Submit a preliminary Schedule of Submittals within ten (10) days after Effective Date of Agreement (EDA).

3. 00700 Paragraph 2.05 - Submit a Schedule of Values within ten (10) days after EDA.

4. 00700 Paragraph 2.05 - Submit a preliminary progress schedule within ten (10) days after EDA.

5. 01050 Paragraph 1.03(A) - Submit name, address and copy of license of the Professional Land Surveyor to be used on this project to the Engineer within fifteen (15) days of the Notice to proceed (NTP).

6. 01310 Paragraph 1.02(D) - Submit a statement of CPM capability in writing to the Engineer within ten (10) calendar days of EDA.

7. 01380 Paragraph 1.03(A) - Complete and submit a videotape of the entire construction site prior to the start of construction.

8. 01590 Paragraph 1.03(B) - Submit layout of Engineer's Field Office and product data on furnishings for Engineer's approval prior to arrival on site.

9. 01630 Paragraph 1.04(A) - Submit, within thirty (30) days of issuance of Notice of Award (NOA), complete data as set forth to permit complete analysis of all proposed substitutions.

In addition to the early submittal and notification requirements listed above, the Contractor shall be responsible for reviewing and complying with the submittal requirements associated with each Technical Specification. Timely submission of many of these items may eliminate potential delays in the future.

1.06 ABBREVIATIONS AND REFERENCES

A. Whenever reference is made to the furnishing of materials or testing thereof to conform to the standards of any technical society, organization or body, it shall be construed to mean the latest standard, code, specification or tentative specification adopted and published at the date of advertisement for bids, even if reference has been made to an earlier standard. Where standards, specifications or codes of the various technical societies, organizations or bodies have been referred to throughout the Specifications, the referenced standard, specification or code is hereby made a part of the Contract the same as if herein repeated in full. In the event of any conflict between any of these specifications, standards, codes or tentative specifications, and the Specifications, the latter shall govern.

B. Reference to a technical society, organization, or body may be made in the Specifications by abbreviations, in accordance with the following list:

AASHTO -	The American Association of State Highway and Transportation Officials
ACI -	American Concrete Institute
AISC -	American Institute of Steel Construction
AGA -	American Gas Association
ANSI -	American National Standards Institute
ASCE -	American Society of Civil Engineers
ASME -	American Society at Mechanical Engineers
ASTM -	American Society of Testing Materials
AWS -	American Welding Society
AWWA-	American Water Works Association
DIPRA -	Ductile Iron Pipe Research Association
EPA -	Environmental Protection Agency
FED.SPEC.	Federal Specifications
GRI	Geosynthetic Research Institute
IEEE -	Institute of Electrical and Electronic Engineers
OSHA -	Occupation Health and Safety Act
NCDOT-	North Carolina Department of Transportation
NEMA -	National Electrical Manufacturers Association

C. When no reference is made to a code, standard, or specification, the standard specifications of the ASTM, the ANSI, the ASME, the IEEE, the GRI or the NEMA shall govern.

1.07 CONSTRUCTION AREAS

A. Contractor shall limit the use of the construction areas for Work and for storage to allow for:

1. Work by other contractors.
2. Owner's use.

B. Contractor shall coordinate use of work site.

C. Contractor shall assume full responsibility for the protection and safekeeping of Products under this Contract, stored on the site.

D. Contractor shall move any stored Products, under Contractor's contract, which interfere with operations of the Owner or other contractors.

E. Contractor shall obtain and pay for the use of additional storage or work areas as needed for operations.

F. Contractor shall at all times conduct his operation as to insure the least inconvenience to the facility operations and general public.

1.08 PLANS AND SPECIFICATIONS

A. Specifications

The Technical Specifications consist of three parts: General, Products and Execution. The General Section contains General Requirements, which govern the work. Products and Execution modify and supplement these detailed requirements of the work and shall always govern whenever there appears to be a conflict.

B. Intent

All work called for in the Specifications applicable to this Contract, but not shown on the Plans in their present form, or vice versa, shall be of like effect as if shown or mentioned in both. Work not specified in either the Plans or in the Specifications, but involved in carrying out their intent or in the complete and proper execution of the work, is required and shall be performed by the Contractor as though it were specifically delineated or described.

The apparent silence of the Specifications as to any detail, or the apparent omission from them of a detailed description, concerning any work to be done and materials to be furnished, shall be regarded as meaning that only the best general practice is to prevail and that only material and workmanship of the best quality is to be used, and interpretation of these specifications shall be made upon that basis.

The inclusion of the General Requirements (or work specified elsewhere) in the General part of the Specifications is only for the convenience of the Contractor and shall not be interpreted as a complete list of related Specification Sections.

PART 2: PRODUCTS (Not Used)

PART 3: EXECUTION (Not Used)

END OF SECTION

SECTION 01025

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. All contract prices included in Section 00300 will be full compensation for all labor, materials, tools, equipment and incidentals necessary to complete the Work as shown on the Drawings and specified in the Contract Documents to be performed under this Contract.

B. The items listed below, refer to and are the same pay items listed in the Bid Form. They constitute all of the pay items for the completion of the Work. No direct or separate payment will be made for providing miscellaneous temporary or accessory works, services, field offices, layout surveys, job signs, sanitary requirements, testing, safety devices, water supplies, power, maintaining traffic, removal of waste, watchmen, and all other requirements of the General Conditions and DIVISION 1 - GENERAL REQUIREMENTS. Compensation for all such services, equipment and materials shall be included in the prices stipulated for the lump sum and unit pay items listed herein. No direct or separate payment will be made for certified surveys where required to document quantities. The cost for certified surveys shall be included in the unit cost for each of the applicable bid items.

C. Each lump sum and unit bid price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. Restoration is not a separate pay item but is considered to be an integral part of the work under the contract, and all contract bid prices include the cost of restoration necessitated by the work related to that bid item. Restoration includes existing structures and property, paving, stabilized roads, drainage piping and ditches, catch basins, head walls, driveways, lawns and ground areas, walkways which are altered, removed, or damaged during construction. Cleanup is an integral part of restoration.

E. For purposes of measurement and payment, the term surface area is defined as the horizontal surface measured from a certified survey. The unit price bid for all items measured in surface area shall account for any necessary slope adjustments.

1.02 PAY ITEMS

TOTAL BID – ITEMS 1 - 34

A. Item 1 – Clearing and Grubbing

1. Measurement: The number of acres of site cleared and grubbed as measured in plan view of the certified surveyed limits and verified by the Engineer.

2. Payment: The unit bid price per acre for this line item will be full compensation for all labor, materials, equipment, and incidentals required to perform the clearing and grubbing and all else for which separate payment is not provided under other items. No payment

shall be made for work which a certified survey, as required by Section 01050, has not been submitted and approved by the Engineer, or for material resulting from clearing and grubbing not disposed of properly, or excess areas outside of the construction limits. Clearing of areas outside the designated construction limits must first be approved by the Engineer.

B. Item 2 – Grinding of Cleared Vegetation

1. Measurement: The unit bid price per cubic yard which will be paid for under this item shall include grinding of all the cleared vegetation removed under Item 1 and stockpiled in the area designated by the Owner.

2. Payment: The number of cubic yards measured by certified survey shall be full compensation for all labor, tools, equipment, supervision and incidentals required to perform onsite grinding of the cleared vegetation removed from the project area, including stockpiling of the resulting mulch material at a location identified on the plans. Grinding shall achieve a maximum 2-inch screen size with no shredded material. All stockpile locations shall require positive drainage. Payment for stockpiling of the mulch shall be included in this bid item for the specific work.

C. Item 3 – Stripping, Transport and Stockpile of Vegetation and Organics

1. Measurement: The number of square yards of area stripped of vegetation and organic soils removed to be paid for under this item will be the actual number of square yards, or partials thereof, stripped of vegetation and organics removed as measured by the survey of the limits of vegetation and unsuitable soil removal. The area measurement for payment will be verified by the Engineer.

2. Payment: The unit bid price per square yard for this line item will be full compensation for all labor, tools, equipment, supervision and incidentals required to perform the stripping of vegetation and organics removal as specified herein, including disposal of vegetation and organics onsite at a location identified on the plans or as directed by the Owner. No payment will be made for any stripping of vegetation or organics removal beyond the limits of construction shown on the drawings, or for which certifying surveys, required by Section 01050, have not been submitted and approved by the Engineer. Contractor shall strip the vegetation and organics to the minimum depth necessary to remove all unsuitable material per the Engineer. Payment for removal and stockpiling of organic matter shall be included in the bid item for the specific work.

D. Item 4 – Undercut, Transport, and Stockpile of Unsuitable Materials

1. Measurement: The quantity of unsuitable materials including leachate saturated soils that are undercut, transported, and stockpiled to be paid for under this item will be the actual number of cubic yards of unsuitable materials excavated at the direction of the Engineer and measured by comparing topographic surveys performed before and after excavation. The volume will be verified by the Engineer.

2. Payment: The unit bid price per cubic yard for this item will be full compensation for all labor, materials, tools, equipment, supervision, certifying surveying, and incidentals required to perform all work required to complete the undercutting of unsuitable materials as specified herein including but not limited to, excavating, transporting, stockpiling at the

location shown on the plans, grading, surface preparation, drainage and dewatering, test pits to verify location and depth of existing buried utilities and other facilities, care and protection of existing utilities and structures, conformance to all state, federal and Cabarrus County Standards and requirements, and all other work required for or incidental to the satisfactory completion of all Work under this contract for which payment is not provided under other items in the bid form. For this pay item, unsuitable soils shall include soils that are excessively wet, contain excessive rocks, or are deemed otherwise unsuitable in the judgment of the Engineer. No payment will be made for any undercutting of unsuitable materials for which certifying surveys, required by Section 01050, have not been submitted and approved by the Engineer. No payment will be made for undercutting of unsuitable materials that exceed the area; extent and depth designated by the Engineer without prior approval of the Engineer.

E. Item 5 – Undercut, Transport and Dispose of MSW Waste at a Permitted Waste Facility

1. Measurement: The quantity of municipal solid waste (MSW) that is to be undercut, transported, and disposed of at a permitted Solid Waste Facility under this item will be the actual number of tons of waste weighed first at the Cabarrus County landfill and then weighed again at the permitted waste disposal facility. All tonnages are to be verified by ticket(s) provided from the waste disposal facility and submitted to the Engineer.

3. Payment: The per ton unit price for this item will be full compensation for all labor, materials, tools, equipment, supervision, and incidentals required to perform all work required to complete the removal of MSW waste as specified herein, including but not limited to, excavating, weighing, transporting, disposal, conformance to all state, federal and Cabarrus County Standards and requirements, and all other work required for or incidental to the satisfactory completion of all Work under this contract for which payment is not provided under other items in the bid form. No payment will be made for any waste disposal for which weigh tickets identifying the actual tonnage from both the Cabarrus landfill and the waste disposal facility have not been submitted to the Engineer.

F. Item 6 – Excavate, Transport and Install Subgrade Soil from Onsite Borrow

1. Measurement: The quantity of subgrade soil that is excavated, transported, stockpiled, and installed to be paid for under this item will be the actual number of cubic yards measured by comparing surveyed surfaces performed before and after the placement of the subgrade soil material, to include preparation of the liner subgrade and perimeter berm to the satisfaction of the Engineer. The Engineer will verify the cubic yards.

2. Payment: The unit bid price per cubic yard for this item will be full compensation for all labor, materials, tools, certification tests, equipment, supervision, certifying surveying, and incidentals required to perform all work required to complete the installation of liner subgrade soil material as shown on the Drawings and specified herein including but not limited to, excavating, transporting, stockpiling, rough grading, compacting, fine grading and surface preparation, testing, site restoration, borrow investigations and surveys, conformance with all state, federal and Cabarrus County Standards and requirements, and all other work required for or incidental to the satisfactory completion of all Work under this contract for which payment is not provided under other items in the bid form. No payment will be made for any subgrade soil material for which certifying surveys, required by Section 01050, have not been submitted and approved by the Engineer. No payment

will be made for subgrade soil material that exceeds the specified minimum thickness requirement without prior approval by the Engineer.

G. Item 7 – Furnish and Install Primary and Secondary 40 mil Textured HDPE Geomembrane

1. Measurement: The quantity of primary and secondary 40 mil textured HDPE geomembrane which will be paid for under this item will be the actual number of square yards in place as measured in plan area excluding seam overlaps, vertical liner placement within anchor trenches, folded liner material, drainage flaps, and sacrificial liner material. The Engineer will verify the square yards.

2. Payment: The unit bid price per square yard for this item will be full compensation for all labor, materials, tools, equipment, certification surveying, testing, equipment, supervision, and incidentals required to furnish and install 40 mil textured HDPE geomembrane as shown on the Drawings and specified herein including, but not limited to, seaming, repairs, liner penetrations and boots, removal of gas bubbles from beneath the geomembrane, excavation and backfill of anchor trenches, sandbags, temporary stormwater diversions, and protection of stockpiled and installed materials, quality control and all other work required for or incidental to the satisfactory completion of all Work under this contract for which payment is not provided under other items in the bid form. No payment will be made for any HDPE geomembrane areas for which certifying surveys, required by Section 01050, have not been submitted and approved by the Engineer.

H. Item 8 – Furnish and Install Primary Composite Drainage Net

1. Measurement: The quantity of primary composite drainage net to be paid for under this item will be the actual number of square yards in place as measured in plan area excluding seam overlaps, vertical composite placement within anchor trenches, drainage flaps and sacrificial drainage net material. The Engineer will verify the square yards.

2. Payment: The unit bid price per square yard for this item will be full compensation for all labor, materials, tools, equipment, certification surveying, testing, equipment, supervision, and incidentals required to furnish and install the composite drainage net layer as shown on the Drawings and specified herein including, but not limited to, seaming, folds, repairs, penetrations, drainage flaps, stone and geotextile drains at perimeter channel, placement in anchor trenches, sandbags, temporary stormwater diversions, and protection of stockpiled and installed materials, testing and quality control. No payment will be made for any composite drainage layer areas for which certifying surveys, required by Section 01050, have not been submitted and approved by the Engineer.

I. Item 9 – Furnish and Install Secondary Sand Drainage Layer from Offsite Borrow

1. Measurement: The quantity of sand drainage layer material which will be paid for under this item will be the actual number of square yards in place with a minimum thickness of 10 inches and a hydraulic conductivity of 5×10^{-5} cm/sec or greater (more permeable) as specified herein and measured in plan view of the certified surveyed area provided by the Contractor and verified by the Engineer.

1. Payment: The unit bid price per square yard for this item will be full compensation for all labor, materials, equipment, transport and incidentals required to perform the drainage layer installation within the limits as shown on the Contract Drawings and all else for

which separate payment is not provided under other items. No payment will be made for any installed drainage layer material for which certified surveys, required by Section 01050, have not been submitted and approved by the Engineer.

J. Item 10 – Furnish and Install Primary Sand Drainage Layer from Offsite Borrow

1. Measurement: The quantity of sand drainage layer material which will be paid for under this item will be the actual number of square yards in place with a minimum thickness of 24 inches and a hydraulic conductivity of 5×10^{-5} cm/sec or greater (more permeable) as specified herein and measured in plan view of the certified surveyed area provided by the Contractor and verified by the Engineer.

1. Payment: The unit bid price per square yard for this item will be full compensation for all labor, materials, equipment, transport and incidentals required to perform the drainage layer installation within the limits as shown on the Contract Drawings and all else for which separate payment is not provided under other items. No payment will be made for any installed drainage layer material for which certified surveys, required by Section 01050, have not been submitted and approved by the Engineer.

K. Item 11 – Furnish and Install HDPE Piping

1. Measurement: The quantity of various HDPE piping to be paid under this item will be the number of linear feet of the pipe installed in accordance with the Contract Documents, with the exception of the leachate cleanouts to be paid for by each. Pipe lengths will be measured separately for the various diameters and type (solid or perforated) according to the categories listed in the Bid Form. Pipe lengths will be measured along the horizontal centerline of the pipe with no deduction for fittings. Measurement will be to the nearest tenth of a foot.

2. Payment: The unit bid price per linear foot for this item will be full compensation for all labor, materials, equipment and incidentals required to furnish and install the pipe as shown on the Drawings and specified herein including where applicable dual containment, washed gravel, filter fabric, perforation, backfilling, fittings, jointing, bedding, cleaning, testing, temporarily plugging open ends, bracing the plug, markers, blind flanges, connection to pump risers in sump, termination end caps, spacers, replacement and restoration of any disturbed areas and all else incidental thereto for which separate payment is not provided under other items. The 4-inch x 2-inch dual containment leachate forcemain installation shall include the cost to make the connection to the leachate storage tank, as well as furnishing and installing the 6-inch diameter CMP protective sleeve across the existing landfill access road to the leachate tank truck loading area. No payment shall be made for work performed beyond the specified limits as shown on the Contract Drawings and for which certified surveys, required by Section 01050, have not been submitted and approved by the Engineer.

L. Item 12 – Furnish and Install Leachate Pump Station, Sump and Valve Vault

1. Measurement: The lump sum unit price for this item will be based on complete installation of the primary and secondary pump stations and sumps installed in accordance with the Contract Documents. This item does not include electrical service and controls that are included in bid item for Electrical Service, Instrumentation and Controls.

2. Payment: The lump sum unit price for the leachate pump station shall be full compensation for all labor, materials, equipment and incidentals required for the complete installation of the primary and secondary leachate pump stations, sumps and valve houses including pumps, piping, discharge piping, 18-inch riser pipes, crushed stone, geotextile, heavy weight fabric cushion, dewatering, sheeting and bracing, backfilling, risers, connecting pipe with all fittings required, jointing, bedding, testing, bracing the plug, restoring surface to grade, surface treatments, markers, bollards, cleanouts, valves, fittings, flow meters, magnetic tape, tracer wire, blind flanges, termination end caps, spacers, pipe supports, containment areas, sump and sump pump, concrete enclosure, insulation, heat tracing, replacement and restoration of any disturbed areas and all else incidental thereto for which separate payment is not provided under other items. No payment shall be made for work performed beyond the specified limits as shown on the Contract Drawings and for which documentation, required by Section 01050, has not been submitted and approved by the Engineer.

M. Item 13 – Furnish and Install Stormwater Segregation Berm

1. Measurement: The unit price bid for this item shall be the number of linear feet of stormwater segregation berm installed as measured along the horizontal centerline of the berm verified by certified survey provided by the Contractor and approved by the Engineer. Measurement will be to the nearest foot.

2. Payment: The per linear foot unit price for the stormwater segregation berm shall be full compensation for all labor, materials, equipment and incidentals required to furnish, transport and construct the stormwater segregation berm from offsite material and all else for which separate payment is not provided under other items. The berm is to be constructed using the same material as specified for the protective cover layer from the same offsite borrow pit. The diesel mounted stormwater pump to be used for stormwater control during the course of the project in the cell area shall be installed at the low-point of the segregation area as shown on the Drawings upon completion of installation of the segregation berm and scrim reinforced tarp. The cost to furnish and operate this pump up until Final Completion will be paid under the erosion and sedimentation control bid item (Item 15). No payment shall be made until the certified survey, required by Section 01050, has been submitted and approved by the Engineer.

N. Item 14 – Furnish and Install Scrim Reinforced Tarp

1. Measurement: The unit quantity price bid for this item will be the number of square yards of material installed in accordance with the Contract Documents, as measured in plan view and verified by certified survey provided by the Contractor and approved by the Engineer. Measurement excludes the square footage needed for seam overlaps.

2. Payment: The per square yard unit price for furnishing and installing the scrim reinforced tarp shall be full compensation for all labor, materials, equipment, and incidentals required to install the tarp and sandbags as specified herein and within the limits shown on the Contract Drawings and all incidental work for which separate payment is not provided under other items. No payment shall be made until the certified survey, required by Section 01050, has been submitted and approved by the Engineer.

O. Item 15 – Furnish, Install and Maintain Stormwater, Sediment and Erosion Control Measures

1. The lump sum price for temporary and permanent sediment and erosion control measures shall be full compensation for all labor, materials, tools, equipment, supervision and incidentals necessary for furnishing and maintaining stormwater, sedimentation and erosion control measures as shown on the Drawings or as otherwise required for adequate control of sedimentation from the site, and specified herein, including controls for both permanent and temporary structures, facilities, stockpiles, borrow areas, ditches, and roadways. Control measures shall include, but not be limited to maintenance of the existing Sediment Pond No. 1 and the perimeter channel of the active landfill, installation of a Sediment Pond No. 2, construction of the sideslope berms and CPP downdrains on the active C&D landfill, installation of sediment traps, temporary diversion berms and ditches, stone check dams, silt fence, riprap, filter fabric, level spreader, erosion control matting, or otherwise required for adequate control of sedimentation from the site. Excavation for the Sediment Pond No. 2 and sediment traps will be paid under Bid Item 25 (General Onsite Excavation). Any backfill necessary for the erosion control will be paid under Bid Item 26 (General Onsite Backfill). This lump sum item shall include providing and installing a stormwater trash pump to remove stormwater in the cell area as needed after a storm event, during construction. The same pump shall be reinstalled at the low point of the stormwater segregation berm after installation of the stormwater segregation berm and tarp as shown on the Drawings. The Contractor will be responsible for operation and maintenance of the pump during the course of the project up until Final Completion. The erosion control shall conform to all Cabarrus County and NCDENR Land Quality Standards and Requirements.

P. Item 16 – Furnish and Install Precast Drop Inlet

1. Measurement: The quantity of precast drop inlet structures will be the actual number of drop inlet structures installed as shown of the Drawing and as verified by the Engineer.

2. Payment: The unit bid price per each for this item shall be full compensation for all labor, materials, tools, equipment, supervision, certifying survey, and incidentals required to perform all work required to complete installation of the drop inlet structures as specified herein including but not limited to survey, excavating, transporting and installation at the locations shown on the plans, grading, site preparation, backfill, drainage and dewatering, conformance of all state, federal and Cabarrus County Standards and requirements, and all other work required for or incidental to the satisfactory completion of all Work under this contract for which payment is not provided under other items in the bid form.

Q. Item 17 – Furnish and Install 24-Inch Diameter RCP Drainage Culverts

1. Measurement: The quantity of 24-Inch RCP culvert pipe paid for under this item will be the number of linear feet of pipe measured in-place horizontally along the centerline of the installed pipe.

2. Payment: The unit bid price per linear foot for this item will be full compensation for excavation, pipe bedding, backfill, surveying, and furnishing and installing pipe, as shown on the drawings and as specified herein, including but not limited to erosion control; filter fabric, riprap; and all other appurtenances as required for which payment is not provided under other items in the bid form. No payment will be made for installation of the 24-inch RCP culvert pipe for which certifying surveys, required by Section 01050, have not been submitted and approved by the Engineer.

R. Item 18 – Furnish and Install Temporary Seeding and Mulching

1. Measurement: The number of square yards of installed temporary seeding and mulching measured for payment under this item based upon the actual number of square yards measured by certified survey, as required in Section 01050, submitted to and approved by the Engineer.

2. Payment: The unit price bid per square yard for this item will be full compensation for performing seeding and mulching within the expansion area, onsite borrow area disturbed by the Contractor, and other incidental areas disturbed by the Contractor as specified herein for which payment is not provided under other items in the bid form. No payment will be made for seeded and mulched areas until the establishment of a sufficient growth of grass as examined and approved by the Engineer and certifying surveys required by Section 01050 have been submitted and approved by the Engineer. No payment shall be made for areas seeded and mulched outside of the limits of construction shown on the Drawings, without prior approval of the Engineer.

S. Item 19 – Furnish and Install Permanent Seeding and Mulching

1. Measurement: The number of square yards of installed permanent seeding and mulching measured for payment under this item based upon the actual number of square yards measured by certified survey, as required in Section 01050, submitted to and approved by the Engineer.

2. Payment: The unit price bid per square yard for this item will be full compensation for performing seeding and mulching within the project area, onsite borrow area disturbed by the Contractor, and other incidental areas disturbed by the Contractor as specified herein for which payment is not provided under other items in the bid form. No payment will be made for seeded and mulched areas until the establishment of a sufficient growth of grass as examined and approved by the Engineer and certifying surveys required by Section 01050 have been submitted and approved by the Engineer. No payment shall be made for areas seeded and mulched outside of the limits of construction shown on the Drawings without prior approval of the Engineer.

T. Item 20 – Jet Clean and Video Inspection of Leachate Collection and Header Lines

1. Measurement: The per linear foot quantity of jet cleaning and video inspection to be paid for under this item will be the actual number of linear feet of newly installed leachate collection pipe and header pipes jet cleaned and videotaped as measured horizontally along the centerline of the pipes and/or structures.

2. Payment: The unit price bid per linear foot for the subdivisions of this item shall be full compensation to jet clean and video tape the new leachate collection and header lines and sumps including but not limited to: videotapes; water supply; debris removal at sumps and debris removal following jet cleaning; access; explosion proof video inspection equipment; and all other appurtenances as required.

U. Item 21 – Geoelectric Leak Location Survey

1. The lump sum price for performing the geoelectric leak location survey shall be full compensation for performing the survey for both the primary and secondary geomembrane

liners as specified herein including, but not limited to equipment; reporting and all other appurtenances, as specified herein, for which payment is not provided under other items in the bid form.

V. Item 22 – Furnish and Install all Electrical Service, Instrumentation and Controls

1. The lump sum price for electrical connections and appurtenances shall be full compensation to furnish and install all electrical connections and appurtenances including, but not limited to: power supply conduit; cable and equipment; pull boxes; transformers; grounding systems; control panels; testing; and all other appurtenances as identified in the Drawings and as specified herein for which payment is not provided under other items in the bid form.

W. Item 23 – Abandon Piezometers

1. Measurement: The quantity of vertical feet of abandoned piezometer to be paid for under this item will be the actual number of vertical feet measured in the field and verified by a Professional Geologist provided and approved by the Engineer. Piezometers are to be properly abandoned and sealed with grout in accordance with 15A NCAC 2C .0113(b)(1), entitled "Abandonment of Wells". Well abandonment records (GW-30 form) for each decommissioned piezometer must be certified by a Licensed Geologist provided by the Contractor in accordance with rule .1623(b)(2)(1) and submitted to the Solid Waste Section in accordance with 15A NCAC 02C.0114(b).

2. Payment: The unit price bid per vertical foot for this item shall be full compensation to abandon the piezometers as shown on the Drawings and specified herein for which payment is not provided under other items in the bid form. No payment will be made without a certified letter report sealed by the Contractor's Professional Geologist, accepted by the NCDENR Solid Waste Section.

X. Item 24 – Install Gas Monitoring Wells

1. Measurement: The quantity of vertical feet of gas monitoring well to be paid for under this item will be the actual number of vertical feet measured in the field and verified by a Professional Geologist provided and approved by the Engineer.

2. Payment: The unit price bid per vertical foot for this item shall be full compensation to install the gas monitoring wells as shown on the Drawings and as directed by the Engineer for which payment is not provided under other items in the bid form.

Y. Item 25 – General Onsite Excavation

1. Measurement: The quantity of general onsite excavation which will paid for under this item will be the actual number of cubic yards measured by comparing surveyed surfaces before and after the general onsite excavation is performed, verified by certified survey and approved by the Engineer.

2. Payment: The unit bid price per cubic yard for this item will be full compensation for all labor, materials, tools, certification tests, equipment, supervision, certifying surveys and incidentals required to perform all work required to complete all excavation work as shown on the Drawings and specified herein including but not limited to all other work

required for or incidental to the satisfactory completion of all Work under this contract for which payment is not provided under other items in the bid form. This includes any excavation required in the cell area, at the tank location, the sediment pond and traps. No payment will be made for any onsite excavation for which certifying surveys required under Section 01050 have not been submitted and approved by the Engineer. No additional compensation will be made for performing certifying surveys.

Z. Item 26 – General Onsite Backfill

1. Measurement: The quantity of general onsite backfill which will be paid for under this item will be the actual number of cubic yards measured by comparing surveyed surfaces before and after the general onsite backfill is performed, verified by certified survey and approved by the Engineer.

2. Payment: The unit bid price per cubic yard for this item will be full compensation for all labor, materials, tools, certification tests, equipment, supervision, certifying surveys and incidentals required to perform all work required to complete general onsite backfill as shown on the Drawings and specified herein including but not limited to all other work required for or incidental to the satisfactory completion of all Work under this contract for which payment is not provided under other items in the bid form. This includes all backfill required using onsite fill material or suitable soil from onsite excavation. The work to be paid under this bid item includes backfill for the cell anchor berm, backfill at the tank location, and backfill for the tank access road. Liner subgrade will be paid under Item 6. No payment will be made for any general onsite backfill for which certifying surveys required under Section 01050 have not been submitted and approved by the Engineer. No additional compensation will be made for performing certifying surveys.

AA. Item 27 – Phased Subcell A Construction

1. The lump sum price for subcell A phased cell construction shall be full compensation for all additional (beyond costs already paid for under other bid items) labor, materials, tools, equipment, supervision and incidentals required to provide the work shown on the Drawings and as specified herein, including but not limited to any other work not specifically included for payment under other items needed to complete the contract. The Owner has the option of incorporating the 1-acre phased cell construction into the project depending on the need to have permitted airspace available for waste disposal prior to completion of the project. Work shall include but not be limited to the full double liner system, leachate collection and header piping, leachate force main piping, sumps, pumps, work in support of the leachate storage tank, as well as additional mobilization and demobilization resulting from the phasing, all related electrical work, submittal of separate testing and as-built data pertaining to subcell A construction within 15 days of Subcell A Substantial Completion, and any incidental work associated with the phased construction. In order to provide the Contractor with ample notice regarding the implementation of a phased approach, the Owner will decide within 45 calendar days of NTP whether or not to implement the phased approach. If the phased approach is implemented, Contractor shall have Subcell A substantially complete within 120 calendar days of NTP. The remaining work shall be substantially complete within 150 calendar days. Please refer to Section 00500 for additional details regarding the phased subcell A construction.

AB. Item 28 – Leachate Tank Truck Loading Area

1. The lump sum price for construction of the leachate tank truck loading area shall be full compensation for all labor, materials, tools, equipment, supervision and incidentals required to provide the work shown on the Drawings and as specified herein, including but not limited to any other work not specifically included for payment under other items needed to complete the contract. Work to be performed under this item shall include work outside of the tank containment wall including but not be limited to construction of the ABC stone tank access road, 12 foot x 30 foot concrete truck loading pad, 4-inch and 6-inch ductile iron pipe with butterfly valves and appurtenances, 12-inch CPP drainage outlet pipe and grass lined drainage ditch, as well as subgrade preparation, material purchase, hauling and onsite stockpile, survey and documentation of material quantities incorporated into this work. Excavation and backfill at the leachate tank loading area will be paid respectively under items 25 and 26.

AC. Item 29 – Geosynthetic Laboratory Services

1. The lump sum price for geosynthetic laboratory services shall be full compensation for all labor, materials, tools, equipment, supervision and incidentals required to provide the conformance and CQA laboratory testing services for geosynthetic materials as specified in Section 01410 and specific material specifications. The lump sum price shall include but not be limited to laboratory testing, certified lab reports, fax reports, collection of samples, sampling equipment, packaging, chain-of-custody forms, delivery charges and sample storage.

AD. Item 30 – Miscellaneous Work and Clean-up

1. The lump sum price for miscellaneous work and clean-up shall be full compensation for all labor, materials, and equipment required to perform the work specified in Section 02901 of the Specifications and as shown on the Drawings, and any other work not specifically included for payment under any other item but obviously necessary to complete the Contract. Partial payments will be based on the breakdown of the item as required in Section 02901. The lump sum price shall also include full compensation for construction schedules as required by Section 01310, all construction photographs as required by Section 01380, pre-construction video photography as required by Section 01390, project record documents as required by Section 01720, traffic control, field offices, temporary access roads, maintenance and repair of existing roads, and seeding of unused stockpile areas.

AE. Item 31 – Bonds, Mobilization, and Insurance

1. Measurement for this item will be based on actual invoiced amounts to substantiate the actual bond and insurance premiums and other invoiced costs, as well as an allowance for mobilization/demobilization.

2. Payment of this item will be made at the applicable lump sum amount, as above determined, and will represent full compensation for providing the required 100 percent Payment Bond, 100 percent Performance Bond, all insurance and mobilization/ demobilization in accordance with the requirements of the General Conditions. Mobilization/demobilization payments will be pro-rated on a monthly basis.

AF. Item 32 – Indemnification

1. Payment will be made to the Contractor on a lump sum basis for considerations for indemnification to Owner and Engineer as specified in the General Conditions. The lump sum amount stated for this item shall be no less than $1,000.

AG. Item 33 - Contingency Allowance (Base Bid)

1. The contingency allowance is to provide payment for unforeseen conditions, which may be encountered in the work and is to be used only upon written work order from the Engineer. The contingency allowance shall be a fixed percentage of the base bid as specified in the Bid Form.

2. The contingency allowance is not part of the Unit Price Contract and is not due to the Contractor except when authorized by a change order executed by the Owner as set forth in the General Conditions.

AH. Item 34 – Alternate No. 1 – Bolted Steel Leachate Storage Tank

1. The lump sum price for construction of the leachate tank shall be full compensation for all labor, materials, tools, equipment, supervision and incidentals required to furnish and install a 150,000 gallons bolted steel tank for storage of leachate as specified in Section 11342. Work to be paid under this item shall include but not limited to design and construction of the tank foundation, erection of the tank, secondary containment wall, tank coating (interior and exterior), influent and effluent leachate piping connections and appurtenances inside the secondary containment wall including, including but not limited to plug and butterfly valves, leachate loadout pump, manway, ladder, 6-inch overflow piping, concrete pad for the loadout pump, and any miscellaneous work for which payment is not provided elsewhere on this bid form. All work outside of the secondary containment wall will be paid under bid item 28. Excavation and backfill at the leachate tank area will be paid respectively under items 25 and 26. Electrical work inside and outside the containment wall will be paid under bid item 22.

AI. Item 35 - Contingency Allowance (Bid Alternate)

1. The contingency allowance is to provide payment for unforeseen conditions, which may be encountered in the work and is to be used only upon written work order from the Engineer. The contingency allowance shall be a fixed percentage of the alternate bid as specified in the Bid Form.

2. The contingency allowance is not part of the Unit Price Contract and is not due to the Contractor except when authorized by a change order executed by the Owner as set forth in the General Conditions.

END OF SECTION

SECTION 01026

SCHEDULE OF VALUES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Submit to the Engineer a Schedule of Values allocated to the various portions of the work as listed in the Bid Form (Section 00300) within 21 days after the Effective Date of the Agreement.

B. Upon request of the Engineer, support the values with data which will substantiate their correctness.

C. The accepted Schedule of Values shall be used only as the basis for the Contractor's Applications for Payment.

1.02 RELATED REQUIREMENTS

A. The Contract Documents include, but are not limited to the following related requirements:

1. Section 00300: Bid Form
2. Section 00700: General Conditions
3. Section 00800: Supplementary General Conditions
4. Section 01027: Applications for Payment

1.03 FORM AND CONTENT OF SCHEDULE OF VALUES

A. Type schedule on a 8-1/2-inch by 14-inch white paper, the form of which is included in Section 00800. Identify schedule with:

1. Title of Project and location.
2. Engineer and Project number.
3. Name and Address of Contractor.
4. Contract designation.
5. Date of submission.

B. Schedule shall list the installed value of the component parts of the Work in sufficient detail to serve as a basis for computing values for progress payments during construction. At a minimum the component parts listed in the bid form shall be used.

C. Identify each line item with the number and title of the respective major section of the specifications.

D. For each major line item list sub-values of major products or operations under the item.

E. For the various portions of the Work:

1. Each item shall include a directly proportional amount of the Contractor's overhead and profit.

2. For items on which progress payments will be requested for stored materials, break down the value into:

   a. The cost of the materials, delivered and unloaded, with taxes paid. Paid invoices are required for materials upon request by the Engineer.

   b. The total installed value.

F. The sum of all values listed in the schedule shall equal the total Contract Sum.

1.04 SUBSCHEDULE OF UNIT MATERIAL VALUES

A. Submit a sub-schedule of unit costs and quantities for:

   1. Products on which progress payments will be requested for stored products.

B. The form of submittal shall parallel that of the Schedule of Values, with each item identified the same as the line item in the Schedule of Values.

C. The unit quantity for bulk materials shall include an allowance for normal waste.

D. The unit values for the materials shall be broken down into:

   1. Cost of the material, delivered and unloaded at the site, with taxes paid.

   2. Copies of invoices for component material shall be included with the payment request in which the material first appears.

   3. Paid invoices shall be provided with the second payment request in which the material appears or no payment shall be allowed and/or may be deleted from the request.

E. The installed unit value multiplied by the quantity listed shall equal the cost of that item in the Schedule of Values.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION

SECTION 01027

APPLICATIONS FOR PAYMENT

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Submit Applications for Payment to the Engineer in accordance with the schedule established by Conditions of the Contract and Agreement between Owner and Contractor.

1.02 RELATED WORK

A. Section 00700: General Conditions

B. Section 01025: Measurement and Payment

C. Section 01026: Schedule of Values

C. Section 01036: Change Order Procedures

D. Section 01050: Field Engineering

E. Section 01700: Contract Closeout

F. Section 01720: Project Record Documents

1.03 SUBMITTALS

A. Submit Applications for Payment in automated format approved by the Owner, with itemized data typed on 8-1/2-in by 11-in or 8-1/2-in by 14-in white paper continuation sheets, with each submittal the Contractor shall submit an electronic copy of a spreadsheet providing complete documentation of all items for which payments is requested. Text and tabular data shall in Excel 2003 or latest version, for Windows format.

B. Provide itemized data on continuation sheet:

1. Format, schedules, line items and values: Those of the Schedule of Values accepted by the Engineer.

C. Contractor shall submit to the Engineer a Request for Payment for work done during the previous calendar month no later than the fifth (5th) day of each calendar month.

D. Any Request for Payment received by the Engineer on or before the fifth (5th) of the calendar month shall be certified for payment or returned for re-submission for the Contractor on or before the fifteenth (15th) of the calendar month.

1.04 PREPARATION OF APPLICATION FOR EACH PROGRESS PAYMENT

A. Application Form:

1. Fill in required information, including that for Change Orders executed prior to date of submittal of application.

2. Fill in summary of dollar values to agree with respective totals indicated on continuation sheets.

3. Execute certification with signature of a responsible officer of Contract firm.

B. Continuation Sheets:

1. Fill in total list of all scheduled component items of Work, with item number and scheduled dollar value for each item.

2. Fill in dollar value in each column for each scheduled line item when work has been performed or products stored.

   a. Round off values to nearest dollar, or as specified for Schedule of Values.

3. List each Change Order executed prior to date of submission, at the end of the continuation sheets.

   a. List by Change Order Number and description, as for an original component item of work.

4. To receive approval for payment on component material stored on site, submit copies of the original paid invoices with the application for payment.

1.05 SUBSTANTIATING DATA FOR PROGRESS PAYMENTS

A. Contractor shall submit with each application for payment the following information:

1. Project.
2. Application number and date.
3. Detailed list of enclosures.
4. For stored products:
   a. Item number and identification as shown on application.
   b. Description of specific material.
   c. Documentary evidence establishing Owner's title to such materials.
   d. Evidence that the stored materials are insured against loss and damage.

B. Submit one copy of data and cover letter for each copy of application.

C. As a prerequisite for payment, Contractor is to submit a "Surety Acknowledgment of Payment Request" letter showing amount of progress payment which the Contractor is requesting.

D. The Contractor is to maintain an updated (AutoCAD) set of drawings to be used as record drawings in accordance with Section 01720. As a prerequisite for monthly progress payments, the Contractor is to exhibit and submit for review the updated record drawings for review by the Owner and the Engineer.

E. The Contractor shall demonstrate, as a prerequisite for monthly progress payments, compliance with all requirements specified in Section 02276 to the Engineer. If the Contractor fails to demonstrate compliance with Section 02276, the Engineer reserves the right to withhold approval of progress payment estimates until such time as the Contractor demonstrates to the Engineer full compliance with the approved erosion and sedimentation control permit and Section 02276.

F. The Contractor shall provide, as a prerequisite for monthly progress payments, an accumulating cost curve (tabular and diagram) indicating schedule, forecast and actual progress.

1.06 PREPARATION OF APPLICATION FOR FINAL PAYMENT

A. Fill in Application form as specified for progress payments.

B. Use continuation sheet for presenting the final statement of accounting as specified in Section 01700 - Contract Closeout.

C. Submit all Project Record Documents in accordance with Sections 01050 and 01720.

1.07 SUBMITTAL PROCEDURE

A. Submit Applications for Payment to the Engineer at the times stipulated in the Agreement.

B. Number: Seven copies of each Application.

C. When the Engineer finds Application properly completed and correct, he/she will transmit certificate for payment to Owner, with copy to Contractor.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION

SECTION 01036

CHANGE ORDER PROCEDURES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Promptly implement change order procedures.

1. Provide full written data required to evaluate changes.

2. Maintain detailed records of work done on a time-and-material/force account basis.

3. Provide full documentation to Engineer on request.

B. Designate in writing the member of Contractor's organization:

1. Who is authorized to accept changes in the Work.

2. Who is responsible for informing others in the Contractor's employ of the authorization of changes in the Work.

1.02 RELATED REQUIREMENTS

A. Section 00500: Agreement.

B. Section 00700: General Conditions.

C. Section 00800: Supplementary General Conditions.

D. Section 01027: Application for Payment.

E. Section 01630: Product Options and Substitutions.

F. Section 01720: Project Record Documents.

1.03 DEFINITIONS

A. Change Order: See Section 00700 and Section 00800.

B. Work Change Directive: A written order to the Contractor, signed by Owner and Engineer, which amends the Contract Documents as described, and authorizes Contractor to proceed with a change which affects the Contract Sum or the Contract Time, for inclusion in a subsequent Change Order.

C. Field Order: A written order to the Contractor signed by the Owner, Engineer and the Contractor, which is issued to interpret/clarify the Contract Documents, order minor changes in

the work and/or memorialize trade-off agreements. The work described by a Field Order is to be accomplished without change to the Contract Price, Contract Time, and/or claims for other costs.

1.04 PRELIMINARY PROCEDURES

A. Owner or Engineer may initiate changes by submitting a Request for Proposal (RFP) to Contractor. Request will include:

1. Detailed description of the Change, Products, and location of the change in the Project.
2. Supplementary or revised Drawings and Specifications.
3. The projected time span for making the change, and a specific statement as to whether overtime work is, or is not, authorized.
4. A specific period of time during which the requested price will be considered valid.
5. Such request is for information only, and is not an instruction to execute the changes, nor to stop work in progress.

B. Contractor may initiate changes by submitting a written notice to Engineer, containing:

1. Description of the proposed changes.
2. Statement of the reason for making the changes.
3. Statement of the effect on the Contract Sum and the Contract Time.
4. Statement of the effect on the work of separate contractors.
5. Documentation supporting any change in Contract Sum or Contract Time, as appropriate.

1.05 WORK CHANGE DIRECTIVE (WCD)

A. In lieu of a Request for Proposal (RFP), Engineer may issue a Work Change Directive (WCD) for Contractor to proceed with a change for subsequent inclusion in a Change Order.

B. Each WCD will describe changes in the Work, both additions and deletions, with attachments of revised Contract Documents to define details of the change, and will designate the method of determining any change in the Contract Sum and any change in Contract Time.

C. Owner and Engineer will sign and date the WCD as authorization for the Contractor to proceed with the changes.

D. Contractor may sign and date the WCD to indicate agreement with the terms therein.

1.06 DOCUMENTATION OF PROPOSALS AND CLAIMS

A. Support each quotation for a lump-sum proposal, and for each unit price which has not previously been established, with sufficient substantiating data to allow Engineer to evaluate the quotation.

B. On request, provide additional data to support time and cost computations.

1. Labor required.
2. Equipment required.

3. Products required.
   a. Recommended source of purchase and unit cost.
   b. Quantities required.
4. Taxes, insurance and bonds.
5. Credit for work deleted from Contract, similarly documented.
6. Overhead and profit.
7. Justification for any change in Contract Time.

C. Support each claim for additional costs, and for work done on a time-and-material/force account basis, with documentation as required for a lump-sum proposal, plus additional information.

1. Name of the Owner's authorized agent who ordered the work, and date of the order.
2. Dates and times work was performed, and by whom.
3. Time record, summary of hours worked, and hourly rates paid.
4. Receipts and invoices for:
   a. Equipment used, listing dates and times of use.
   b. Products used, listing of quantities.
   c. Subcontracts.

D. Document requests for substitutions for Products as specified in Section 01630.

1.07 PREPARATION OF CHANGE ORDERS AND FIELD ORDERS

A. Engineer will prepare each Change Order and Field Order.

B. Forms: See Section 00800 for forms.

C. Change Order will describe changes in the Work, both additions and deletions, with attachments of revised Contract Documents to define details of the change.

D. Change Order will provide an accounting of the adjustment in the Contract Sum and in the Contract Time.

E. Field Order will describe interpretations or clarifications of Contract Documents, order minor changes in the Work, and/or memorialize trade-off agreements.

F. Field Order work will be accomplished without change in the Contract Sum, Contract Time, and/or claims for other costs.

1.08 LUMP-SUM/FIXED PRICE CHANGE ORDER

A. Content of Change Orders will be based on, either:

1. Engineer's Proposal Request and Contractor's responsive Proposal as mutually agreed between Owner and Contractor.

2. Contractor's Proposal for a change, as recommended by Engineer.

B. Owner and Engineer will sign and date the Change Order as authorization for the Contractor to proceed with the changes.

C. Contractor will sign and date the Change Order to indicate agreement with the terms therein.

1.09 UNIT PRICE CHANGE ORDER

A. Content of Change Orders will be based on, either:

1. Engineer's definition of the scope of the required changes.

2. Contractor's Proposal for a change, as recommended by Engineer.

3. Survey of completed work.

B. The amounts of the unit prices to be:

1. Those stated in the Bid Form.

2. The unit prices stated in the Bid Form shall be utilized for all change orders and shall represent the total cost, including overhead and profit unless quantities warrant change per Specification Section 00800.

C. When quantities of each of the items affected by the Change Order can be determined prior to start of the work:

1. Owner and Engineer will sign and date the Change Order as authorization for Contractor to proceed with the changes.

2. Contractor will sign and date the Change Order to indicate agreement with the terms therein.

D. When quantities of the items cannot be determined prior to start of the work:

1. Engineer or Owner may issue a WCD directing Contractor to proceed with the change on the basis of unit prices, and will cite the applicable unit prices.

2. At completion of the change, Engineer will determine the cost of such work based on the unit prices and quantities used.
   a. Contractor shall submit documentation to establish the number of units of each item and any claims for a change in Contract Time.

3. Engineer will sign and date the Change Order to establish the change in Contract Sum and in Contract Time.

4. Owner and Contractor will sign and date the Change Order to indicate their agreement with the terms therein.

1.10 TIME AND MATERIAL/FORCE ACCOUNT CHANGE ORDER/WORK CHANGE DIRECTIVE

A. Engineer and Owner will issue a WCD directing Contractor to proceed with the changes.

B. At completion of the change, Contractor shall submit itemized accounting and supporting data as provided in the Article "Documentation of Proposals and Claims" of this Section.

C. Engineer will determine the allowable cost of such work, as provided in General Conditions and Supplementary Conditions.

D. Engineer will sign and date the Change Order to establish the change in Contract Sum and in Contract Time.

E. Owner and Contractor will sign and date the Change Order to indicate their agreement therewith.

1.11 CORRELATION WITH CONTRACTOR'S SUBMITTALS

A. Periodically revise Schedule of Values and Request for Payment forms to record each change as a separate item of Work, and to record the adjusted Contract Sum.

B. Periodically revise the Construction Schedule to reflect each change in Contract Time.
1. Revise subschedules to show changes for other items of work affected by the changes.

C. Upon completion of work under a Change Order, enter pertinent changes in Record Documents.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01041

PROJECT COORDINATION

PART 1 GENERAL

1.01 General

A. The Work to be performed under this Contract generally includes the construction of a 2.1 acre double-lined cell area. Work is to include the installation of a 40-mil HDPE base liner, geocomposite drainage net, a 10-inch secondary soil drainage layer and 24-inch protective soil drainage layer. Protective cover and secondary drainage layer material shall be obtained from an offsite borrow source with a specified permeability of 5×10^{-5} cm/sec or greater. Work shall include stripping existing vegetation, preparing the liner subgrade and liner installation, as well as a leachate collection system with force main, erosion control measures, seeding and mulching and other incidentals as shown on the Drawings and as noted in the Specifications. The Owner's onsite borrow area will be available for liner subgrade preparation and miscellaneous soil needs. Sorting and processing of the onsite borrow soil may be needed. Work may also include the construction of a Subcell A area within the lined expansion. This will depend on the need for permitted airspace for waste disposal prior to overall project completion. Days will be added to the date of Substantial Completion if this option is selected. In addition, work will also include the construction of a leachate tank truck loading area. A 150,000 gallon leachate storage tank system (including secondary containment, piping, transfer pump, etc.) shall be included as a bid alternate.

B. Access to the Cabarrus County C&D Landfill property will require use of the main entrance road off of Irish Potato Road. The Contractor will be required to submit to the Engineer and Owner a traffic control plan for review. The traffic control plan shall indicate how the Contractor intends to utilize the general construction and heavy equipment entrances, as shown on the drawings, to direct and monitor construction traffic such that the convenience center and landfill facility traffic are not impacted. The traffic control plan shall demonstrate that (1) all landfill user and operator vehicles will intersect construction equipment only at points where the Contractor provides a flagman to control and direct traffic; and (2) landfill user and operator vehicles will not be delayed at these intersections for a period which exceeds one (1) minute.

C. The Contractor shall be aware that there is the potential for landfill gas to be present during the execution of the Work. Proper Health and Safety (H&S) procedures should be implemented prior to conducting any construction activities on the landfill. Other potential on-site hazards include ongoing landfill operations and potential contact with municipal solid waste and leachate.

D. Carefully coordinate and conduct all work in strict accordance with federal, state, and county requirements and standards.

E. The area identified on the Drawings as "Active Borrow Area" shall only be used for the purpose of evaluating or obtaining soil material to be used in the construction of the subgrade and fill. The Contractor is responsible for determining the suitability of borrow material for use in construction and the quantities available. The 24-inch protective cover shall be from offsite

source approved by the Owner and the Engineer that meet the size and permeability requirement specified in Section 02700.

F. All Contractor equipment storage, staging, and stockpile areas shall be located within the designated locations shown on the Drawings or locations as designated by the Owner or landfill operator.

G. Waste soil shall be disposed by Contractor within the borrow area or active face of the landfill at a location designated by the Owner.

H. Contractor shall be aware that the primary and secondary containment leachate storage tanks along with piping and process equipment (within the containment area) will be provided by the Owner under a separate contract. Contractor for the Phase 1L expansion project shall be responsible for grading the tank area, connection of the leachate force main, electrical, the tank load out area, and coordination with the tank contractor. Contractor shall schedule the completion of all work in support of the leachate storage tank facility construction to ensure that the leachate storage facility is complete and operational by the contract date for substantial completion.

1.02 LINES AND GRADES

A. The Contractor shall be responsible for establishing all lines and measurements necessary to the proper execution and control of the work. Available horizontal and vertical controls are shown on the Drawings. Any deviation from the proposed limits of construction or staging and storage areas as shown on the Drawings shall be prohibited without approval from the Engineer and Owner.

1.03 ACCESS AND DRAINAGE

A. The Contractor shall provide and maintain adequate access to and throughout the site and shall keep all natural drainage and water courses unobstructed or provide equal courses effectively placed. He shall maintain drainage facilities to prevent accumulation of surface water. The Owner assumes no responsibility for the placement, condition or maintenance of any access roads or structures that may be used by the Contractor in the performance of his work. The Contractor shall be responsible for maintaining any existing access roads (including dust control) utilized during the construction of this project. Contractor will be responsible for obtaining a permit from either the City of Concord or City of Kannapolis to get water from a hydrant for use in dust control. On-site County sources will not be available for use by the contractor.

B. Contractor shall maintain any stormwater diversion or control measures in accordance with Section 02276.

C. The Contractor shall provide suitable temporary stormwater control measure to control runoff from the MSW Unit 2 slope during construction. Contractor shall provide culverts to allow free flow of stormwater past the crossings. Contractor shall also maintain any stormwater diversion measures in accordance with Section 02276.

1.04 RIGHTS-OF-WAY

A. Work performed in RIGHTS-OF-WAY (R-O-W) shall be subject to the provisions of the R-O-W agreements. In general, these easements provide for restoring the property to the condition existing before construction began, except where otherwise noted on the Drawings.

1.05 PROVISIONS FOR THE CONTROL OF DUST AND MUD

A. Sufficient precautions shall be taken during construction to minimize dust.

B. Sufficient precautions shall be taken during construction to minimize the tracking of mud onto the paved access roads at the landfill. Mud shall be removed by Contractor from paved roads at least daily and more frequently as conditions warrant as determined by the Owner.

1.06 LOCATION, PROTECTION AND MAINTENANCE OF EXISTING UTILITIES, STRUCTURES AND PROPERTY

A. Existing utilities are located and are operating in the construction area. Contractor shall contact the office of each utility operator and ascertain the extent of specific service areas. Contractor shall contact the Utilities Locating Company (PULS) at least 48 hours prior to excavating.

B. The location of existing utilities across or along the line of the proposed work is not necessarily shown on the Drawings and where shown is only approximately correct. The Contractor shall locate all underground lines and structures prior to excavation.

C. The Contractor shall assume full responsibility for the protection and restoration of all buildings, structures, and utilities, public or private, including poles, signs, services to buildings, utilities in the street, gas pipes, water pipes, hydrants, sewers, drains, electric and telephone cables, groundwater monitoring wells, and piezometers whether or not they are shown on the Drawings. Contractor shall carefully support and protect all such structures and utilities from injury. Damages resulting from the construction operations shall be repaired by Contractor at no cost to Owner.

D. The Contractor shall fully cooperate at all times with the utility owners to maintain the operation of existing utilities with the least amount of interference and interruption possible. Continuous service, public health and safety considerations shall exceed all others and the Contractor's schedule, plans and work shall at all times be subject to alteration and revision if necessary for these considerations.

E. Temporary support, adequate protection and maintenance of all underground and surface utility installations and structures, drains, sewers, and other obstructions encountered shall be provided as required by the Contractor Arrange and pay all costs for required support of utility poles and other structures as required by the utility owners prior to excavation.

F. No wetland areas outside the limits of construction shall be disturbed. Trees, shrubbery, fences, poles, signs and all other property shall be protected to the extent practicable.

1.07 RELOCATION OF UTILITIES AND STRUCTURES

A. The Contractor shall be responsible for the temporary or permanent relocation of structures and utilities, including but not limited to poles, signs, fences, hydrants, valves, piping, conduits and drains that interfere with the positioning of the Work as shown on the Drawings.

B. No relocations of utilities shall be made without approval from the owner of the utility.

C. All valve boxes and manhole frames and covers in intersections and elsewhere shall be adjusted as required to be flush with the final pavement surface.

1.08 CLAIMS FOR PROPERTY DAMAGE

A. Upon notification by the Owner, the Contractor shall investigate each claim for property damage and shall file, within ten (10) days of such notification, a statement with Owner setting forth all facts and details relative to such claim.

1.09 CARE AND PROTECTION OF PROPERTY

A. The Contractor shall be responsible for the preservation of all public and private property (including wetlands) and shall use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work on the part of the Contractor, such property shall be restored by the Contractor, at his expense, to a condition similar or equal to that existing before the damage was done, or he shall make good the damage in other manner acceptable to the Engineer.

B. The Contractor shall be responsible for the clean-up of all wind blown debris (within the construction limits) from operations that impact his/her ability to properly complete the work.

C. All driveways, sidewalks, curbs and gutters disturbed by the Contractor's operations shall be restored to their original condition in accordance with NCDOT and County requirements.

D. All fences, signs, mailboxes, and other physical features shall be protected and restored in a workmanlike manner by the Contractor. Fences and other features removed by the Contractor shall be replaced as soon as conditions permit. All grass areas beyond the limits of construction which have been damaged by the Contractor shall be regraded and restored to their original condition.

1.10 PROTECTION OF CONSTRUCTION AND EQUIPMENT

A. All newly constructed work shall be carefully protected from injury in any way. No wheeling or walking or placing of heavy loads on it shall be allowed and all portions injured shall be reconstructed by the Contractor at his own expense.

B. All structures shall be protected in a manner approved by the Engineer. Should any of the surfaces or other parts of the structures become heaved, cracked or otherwise damaged, all such damaged portions of the work shall be completely repaired and made good by the Contractor at his own expense and to the satisfaction of the Engineer. If, in the final inspection of the work, any defects, faults or omissions are found, the CONTRACTOR shall cause the same to be repaired or removed and replaced by the proper materials and labor required. Further, the Contractor shall be fully responsible for the satisfactory maintenance and repair of the construction and other work undertaken herein, for at least the guarantee period described in the Contract.

C. The Contractor shall take all necessary precautions to prevent damage to any structure due to water pressure during and after construction and until such structure is accepted by the Owner.

D. The Contractor shall maintain the Work during construction and until the project is accepted. This maintenance shall constitute continuous and effective work prosecuted day by day, with adequate equipment and forces to the end that the road or structures are kept in a satisfactory condition at all times.

E. All costs of maintenance work during construction and before the project is accepted shall be included in the lump sum and/or unit prices bid on various pay items and the Contractor will not be paid an additional amount for such work.

1.11 FAILURE TO MAINTAIN ROADWAY AND DRAINAGE

A. If the Contractor, at any time, fails to comply with the provisions of Paragraph 1.03, the Owner/Engineer will immediately notify the Contractor of such non-compliance. If the Contractor fails to remedy the unsatisfactory maintenance within 24 hours after receipt of such notice, the Owner will immediately proceed to maintain the project, and the entire cost of his maintenance will be deducted from the monies due or to become due the Contractor on the Contract.

1.12 HURRICANE PREPAREDNESS PLAN

A. Within fifteen (15) days of the date of Notice to Proceed, the Contractor shall submit to the Engineer and Owner a Hurricane Preparedness Plan. The plan should outline the necessary measures which the Contractor proposes to perform at no additional cost to the Owner in the event of a hurricane warning. Such measures shall be in accordance with state and local requirements.

B. In the event of inclement weather, the Contractor will, and will cause Subcontractors, to protect carefully the Work and materials against damage or injury from the weather at no additional cost to the Owner. If, in the opinion of the Engineer, any portion of the Work or materials shall have been damaged or injured by reason of failure on the part of the Contractor or Subcontractors to so protect the work, such Work and materials shall be removed and replaced at the expense of the Contractor.

1.13 DAMAGE DUE TO HIGH WATER

A. The Contractor shall hold himself responsible for all damage done to the Work by heavy rains or flood and Contractor shall take all reasonable precautions to provide against damages in a permittable manner.

1.14 EMERGENCIES

A. The Contractor shall at all times after regular working hours, including weekends and holidays, maintain a telephone where the Contractor or his representative can be reached on a emergency basis. The Contractor or his representative shall be prepared to act to correct conditions on the site deemed to constitute an emergency by either the Owner, his agent, the Engineer, or local authorities and is obligated to act to prevent threatened damage, injury, or loss without special instructions from the Owner, his agent, or the Engineer. The Contractor shall give the Engineer

prompt written notice of all significant changes in the Work or deviations from the Contract caused thereby. If a condition on the site requires attention after working hours, either the Owner, his agent, Engineer, or local authority shall call the Contractor or his representative at the emergency telephone number, identify himself and describe the emergency condition. The Contractor is expected to dispatch men and equipment to adequately institute corrective measures within two (2) hours. If the Contractor or his representative cannot be reached at the emergency number after a reasonable time (½ hour), the Owner shall have the right to immediately initiate corrective measures, and the cost of such measures shall be borne by the Contractor.

B. Emergency phone numbers (fire, medical, police) shall be posted at the Contractor's phone and its location known to all.

C. Accidents or incidents shall be reported immediately to the Engineer by messenger or phone.

D. All accidents or incidents shall be documented and a fully detailed written report, including police reports if produced, submitted to the Engineer after each occurrence.

1.15 PIEZOMETER AND MONITORING WELL PROTECTION

A. Contractor shall provide all necessary measures to temporarily fence and protect existing piezometers and monitoring wells within the limits of construction prior to any construction activity. Contractor shall replace damaged piezometers and monitoring wells at no expense to the Owner.

1.16 GUARANTEE

A. Work on this project shall be guaranteed in accordance with requirements of Article 18 of the General Conditions. Work found to be defective within 1 year (unless otherwise specified) after the date of Substantial Completion shall be corrected or replaced in accordance with the General Conditions.

1.17 DAILY REPORTS

A. The Contractor shall submit daily reports of construction activities for all days including non-work days beginning with the start of construction and terminating with the end of demobilization. The report shall include:

1. Manpower, number of men by craft (trade);

2. Equipment on the project;

3. Major material deliveries;

4. Activities worked with references to the CPM schedule activity numbers;

5. Construction difficulties or concerns; and

6. Any additional pertinent information.

B. A similar report shall be submitted for or by each Subcontractor.

C. Daily reports shall be submitted to the Engineer within two working days of the respective daily report date. Each report shall be signed by the Contractor's Superintendent or Project Manager. Subcontractor daily reports not prepared by the Contractor shall be signed by the Subcontractor's responsible party on site or by the subcontractor's Project Manager.

D. Information provided on the daily report shall not constitute notice of delay or any other notice required by the Contract documents, nor shall it constitute any requests or submittals required by the Contract documents to be in writing. Notices and requests shall be submitted as required therein.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION

SECTION 01050

FIELD ENGINEERING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Contractor shall provide certified survey work required in execution of the Project. The term "certified" as used throughout this Section shall mean work by a surveyor registered to practice in North Carolina.

B. Provide civil, structural, or other professional engineering services specified or required to execute Contractor's construction methods.

C. Provide Record Drawings to be used for recovering quantities and documenting construction. All Record Drawings shall be AutoCad DWG Release 2008 format as specified in the following Sections.

D. The Contractor shall retain the services of a professional land surveyor licensed in the State of North Carolina to:

1. Identify existing control points and property line corner stakes indicated on the Drawings, as required

2. Verify all existing structure locations.

3. Maintain an accurate location of all buried piping and all buried electrical duct banks.

E. The Engineer shall provide AutoCAD files and standards for Record Drawings that are to be maintained by the Contractor. The Contractor will be required to sign and submit the AutoCAD Disclaimer Form at the end of this Section before receiving the AutoCAD files.

F. As a condition for reaching substantial completion, submit certified drawings with complete AutoCAD files signed and sealed by a North Carolina Professional Land Surveyor.

1.02 RELATED WORK

A. Section 01010: Summary of Work

B. Section 01025: Measurement and Payment

C. Section 01027: Applications for Payment

D. Section 01700: Contract Closeout

E. Section 01720: Project Record Documents

1.03 SUBMITTALS

A. Submit name, address, and copy of license of professional land surveyor to be used on this project to the Engineer within 15 days of the Notice to Proceed.

B. Submit certificate with each submittal signed by a North Carolina Professional Land Surveyor certifying that elevations and locations of new work and improvements are in conformance or non-conformance with the Contract Documents.

C. The Contractor is required to submit surveys prepared, signed and sealed by a professional land surveyor. All surveys shall be tied to North Carolina State Plane Coordinate System, NAD 1983 (Horizontal) and NAVD-29 (Vertical). All information in the AutoCAD file must be at appropriate 3-D elevation and coordinate. All entities shall be placed on layer names which adequately described the entity being mapped.

D. On request of the Engineer, submit documentation to verify accuracy of field engineering work.

E. At the end of the project, and prior to final payment, submit certified drawings (signed and sealed by the professional land surveyor) of the items listed below. These drawings shall be included with, and made a part of, the project record documents.

The CONTRACTOR'S surveyor is required to perform, and submit to the ENGINEER the following types of surveys:

1. Certified aerial and field topographic map surveys and Digital Terrain Models (DTM) shall be performed for:

    a. Immediately following clearing and grubbing or stripping, and prior to starting excavation and backfilling. This topographic mapping shall be developed from Global Positioning System (GPS).

    b. Immediately following completion of excavation, backfilling and prior to starting placement of liner subgrade and synthetic liner. These intermediate surveys for the purpose of verifying pay quantities can be developed from field surveys.

    c. Top of Liner Subgrade Survey shall be performed following the placement of additional soil to obtain the minimum 12-inch intermediate cover thickness and smooth lines and grades. This survey will be used to verify the thickness of the Liner Subgrade.

    d. Top of Drainage Layer Survey shall be performed following the placement of the 24-inch drainage layer over the 40 mil HDPE geomembrane and the geocomposite drainage layer. This survey will be used to verify the thickness of the drainage layer.

    e. The entire Cabarrus County construction and Demolition Debris Landfill Closure area at the time the Contractor intends to submit documentation to support a claim for substantial completion. This survey shall be developed from aerial photos.

The surveys shall meet the following criteria:

1) 1" = 100' scale reproducible plot.

2) Produced at national map accuracy standards for 1" = 100' scale maps.

3) A Digital Terrain Model (DTM) shall be generated from the data obtained from each topographic survey showing a 2-foot contour interval. The DTM must contain adequate 3-D points and 3-D breaklines required to accurately model the surveyed surface to within above stated accuracy. The DTM must also provide a 2-D polyline defining the limits of the area surveyed. The

points, breaklines, and survey limits line shall be on separate layers. The AutoCAD file of the DTM model must be compatible for use with Land Development Desktop software.

4) All surveys shall be performed on a minimum 50-foot grid pattern and at any other points needed by the CONTRACTOR to control thickness and grades. Identical horizontal points shall be used for all surveys. Each survey shall contain the elevation and/or thickness data from the previous surfaces that were surveyed. Depth verification surveys may be performed by either taking elevations or probing on the established 50-foot grid pattern. Probing above geosynthetic components shall incorporate precautions to avoid damaging these components and is subject to prior approval of OWNER and ENGINEER.

5) All elevation data shall be presented to the nearest tenth of a foot.

2. A Certified Record "As-Built" Drawing Survey of the existing surface structures and structures installed by CONTRACTOR shall be provided after completion of the project and shall include the following:

a. Surface Facilities - Including, but not limited to, centerlines of swales and berms, gas extraction wells, buried valves, other liner penetrations, and downdrains.

b. Subsurface Facilities – Including corrugated HDPE pipe, and limits of the 40 mil LLDPE liner showing the location of all panels, labeling of all seams, and the locations and labeling of all destructive seam tests, repairs, and other information required to document liner installation.

c. Topographic features with minimum 2-foot contour lines – Including swales and berms and covering a minimum of 50-feet beyond limits of liner.

3. Certified surveys as required to verify pay request quantities.

F. The Contractor shall submit each survey on reproducible mylar, along with 3 prints, and on CD-ROM in AutoCAD 2008 format.

1.04 QUALIFICATIONS OF SURVEYOR

A. Professional land surveyor of the discipline required for the specific service on the Project, currently licensed in the State of North Carolina.

1.05 SURVEY REFERENCE POINTS

A. Existing basic horizontal and vertical control points for the Project are those designated on Drawings. Notify Engineer immediately if any discrepancy is observed between Contractor's control points and control points shown on the Drawings.

B. Locate and protect control points prior to starting site work and preserve all permanent reference points during construction.

1. Make no changes or relocations without prior written notice to the Engineer.

2. Report to the Engineer when any reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.

3. Require surveyor to correctly replace project control points which may be lost or destroyed.
   a. Establish replacements based on original horizontal and vertical survey control.

1.06 PROJECT SURVEY REQUIREMENTS

A. Establish a minimum of two permanent benchmarks on site, referenced to data established by survey control points.

1. Record locations, with horizontal and vertical data, on Project Record Documents.

B. Establish lines and levels, locate and lay out, by instrumentation and similar appropriate means:

1. Site improvements
   a. Stakes for grading, fill and topsoil placement.
   b. Utility slopes and invert elevations.

2. Batter boards for structures.

3. Building foundation, column locations, floor levels, and wall lines at all elevations by string or chalk lines.

4. Controlling lines and levels required for mechanical and electrical trades.

C. From time to time, verify layouts by same methods.

D. Establish all lines and grades prior to construction of line work for all pipelines at 50-ft increments and at defined breaks in grade.

1.07 RECORDS

A. Maintain a complete, accurate log of all control and survey work as it progresses.

B. Update the Project Record Drawings on a monthly basis based on the work performed during the month ending at the pay request as a condition for approval of monthly progress payment requests.

C. Maintain an accurate record of all changes, revisions, and modifications.

D. All field survey notes will be retained by the Surveyor. The results from the field surveys will be documented on a set of Survey Record (As-Built) Drawings signed and sealed by a registered professional Engineer or professional land surveyor licensed in the State of North Carolina. The Contractor shall certify to the Owner that the results of the survey demonstrate compliance with the Contract Documents. These drawings shall, at a minimum, show the final elevations and locations of all surfaces and appurtenances surveyed.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

AUTOCAD DISK COPY
DISCLAIMER

As an accommodation to _____ (Contractor), Camp Dresser & McKee agrees to provide Contractor an electronic copy of the AutoCAD disk used to develop the Conformed Contract Drawings (Drawing Nos.____through ___) for the Cabarrus County Construction and Demolition Debris Landfill Closure project. The information contained may include all information, which is shown on the Conformed Contract Drawings. Contractor is aware of the potential errors that may arise through the electronic copying of the AutoCAD disk.

This AutoCAD disk is provided to Contractor AS IS and Contractor may use this AutoCAD disk for the construction of the Cabarrus County Construction and Demolition Debris Landfill Closure project. Any use on any other project is strictly prohibited. The copyright of information contained on this disk shall remain with Camp Dresser & McKee.

Camp Dresser & McKee, makes no warranties, expressed or implied, including merchantability or fitness for the particular purpose relating to the accuracy or completeness of the information contained on this disk itself or the subsequent use of the information contained on this disk.

Acknowledgment by Contractor:

Name (printed):_____

Title:_____

Signature:_____

Dated_____

END OF SECTION

SECTION 01101

SAFETY, HEALTH AND EMERGENCY RESPONSE REQUIREMENTS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section describes the responsibilities of the Contractor for safety, health, and emergency response. Owner requires that work performed under this specification will not result in:

1. Injuries to employees or other persons.

2. Employee exposures to health hazards above the occupational limits established by the Occupational Health and Safety Administration (OSHA), the American Conference of Governmental Industrial Hygienists (ACGIH), or the Nuclear Regulatory Commission (NRC).

3. Exposure of area residents to air contaminants above the levels established for general public exposure by Environmental Protection Agency (EPA), NRC, or the State in which work occurs.

4. Significant increases in the levels of contaminants in soil, water, or sediment near the site.

5. Violations of OSHA, EPA, NRC, or State regulations.

B. Any disregard for the provision of these Health and Safety requirements may be deemed just and sufficient cause for termination of the Contract without compensation for such termination.

C. Maintain a comprehensive health and safety program that addresses lines of authority and responsibility for health and safety, medical monitoring, training and equipment programs, and health and safety record keeping. Site-specific requirements are discussed elsewhere in this Section.

1.02 BACKGROUND

A. A description of the site and the hazards present within its bounds appears in Section 01041 - Project Coordination.

1.03 SUBMITTALS

A Submit the following documentation to the Engineer at the Pre-Construction conference:

1. Name of Contractor's Health and Safety Officer

2. A statement reflecting the number of employees proposed for this project who have completed the training and medical requirements required for hazardous waste projects.

B. Submit to the Owner and Engineer, in accordance with Section 01300, within 7 calendar days after the Pre-Construction conference or within 7 calendar days after initiating mobilization activity, whichever is sooner, the following information:

1. A Health and Safety Plan, which addresses the issues described in Paragraphs 1.09 B and C below.

2. Certification of Health and Safety Officer's authority.

3. Name and address of Contractor's consulting physician.

4. Name and resume of Health and Safety Professional.

5. Personal protection (including respiratory) programs, as applicable.

1.04 REGULATORY REQUIREMENTS

A. Contractor's health and safety practices shall follow the standards and guidelines established in the publications listed below. These standards are incorporated in this Section by reference:

1. Safety and Health Standards 29 CFR 1910 (General Industry), US Department of Labor, OSHA. (Hereafter, referred as "29 CFR 1910").

2. OSHA Safety and Health Standards 29 CFR 1926 (Construction Industry), US Department of Labor, OSHA.

3. OSHA 29 CFR 1910.120 Hazardous Waste Operations and Emergency Response, U.S. Dept. of Labor, OSHA, and the corresponding construction standard 29 CFR 1926.62.

4. Standard Operating Safety Guides, EPA, Office of Emergency and Remedial Response PB92-983414.

5. Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, US Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health (NIOSH).

B. This Section implements and amplifies procedures and requirements of the above referenced regulations and guidelines. These publications define terms and establishes procedures discussed in this Section, which incorporates them by reference. Where conflicts arise between the requirements of this Section and the above-listed standards and guidelines, the most restrictive requirement shall apply.

1.05 CONTRACTOR'S PERSONNEL

A. Assign persons to fill each of the following roles. An individual can fill as many roles as he or she is qualified.

B. Health and Safety Officer - Designate an employee or company principal as its health and safety officer (HSO). This HSO must have the authority to command sufficient resources to safely

perform the Work. Contractor shall identify its HSO in the site safety and health plan. Owner will direct health and safety correspondence to this HSO.

C. Health and Safety Professional - Contractor shall designate a health and safety professional to take responsibility for evaluating hazards of the site and controls that will appear in the site safety plan. This professional shall be certified as either a certified industrial hygienist (CIH) or a certified safety professional.

D. Site Health and Safety Coordinator

1. Designate a Site Health and Safety Coordinator (SHSC) for this project. Day-to-day industrial hygiene support, including air monitoring, training, site safety inspections, shall be provided by the SHSC. SHSC shall have the authority to stop on-site operations when conditions threaten the health or safety of employees. The SHSC shall remain on-site during all project operations.

2. SHSC shall report directly to the HSO or the CIH. SHSC shall have a sound working knowledge of occupational safety and health regulations, experience in the type of project described in these specifications, and training in air monitoring practices and techniques.

3. The SHSC shall have completed all of the training required by OSHA standard 29 CFR 1910.120 paragraph (e), for supervisory personnel.

E. On-site Operations Manager - The on-site activity of this project shall be under the control of an on-site operations manager. This manager shall have demonstratable experience with hazardous materials projects.

F. On-site Workers - All on-site personnel who may be exposed to potential hazardous substances, health hazards, or safety hazards shall have:

1. Completed a 40 hour hazardous waste health and safety training course. Either the forty-hour course or a hazardous waste health and safety refresher training course shall have occurred within the last year. This training shall be certified by its instructor to meet the requirements of OSHA standard 29 CFR 1910.120 paragraph (e).

2. Completed a medical monitoring exam within the last year.

3. Passed a fit test for any respirator they may wear on the site.

G. Competent Person – Projects that involve the following hazards, equipment, or activities require a Competent Person, directly involved with the task, who, by way of training and/or experience, is knowledgeable of applicable standards, is capable of identifying workplace hazards relating to the specific operation, is designated by the employer, and has authority to take prompt corrective measures to eliminate them.

1. Construction Cranes
2. Trenching and Excavation
3. Lift-Slab Operations
4. Steel Erection
5. Powered platforms for building or maintenance

6. Personal Fall Arrest System
7. Scaffolds
8. Compressed Air
9. Exposure in Construction
10. Asbestos Construction
11. Cadmium
12. Ionizing Radiation
13. Lead Construction

1.06 MEDICAL SURVEILLANCE

A. Utilize the services of a licensed physician, board-certified or board-eligible in occupational or internal medicine, to provide a medical surveillance program required by Paragraph 1.05 above.

B. Document any medical monitoring exams required by Paragraph 1.05 above with an occupational physician's written medical opinion for each employee as to whether that employee has medical conditions which would place him or her at increased risk of health impairment from work on this project. The opinion shall also state whether the employee is medically fit to perform the work and to use any respiratory protective devices required for project operations (See Attachment 1 to this Section). These certificates shall have been completed and signed within a year of the beginning of the project.

C. In accordance with 29 CFR 1910.20, maintain all medical surveillance records for thirty years past employment and make these records available to the Owner or regulatory agencies, as required.

1.07 TRAINING

A. Maintain, at the work site, documentation that shows each on-site employee or subcontractor that could be exposed to hazardous substances, health hazards, or safety hazards has completed the training described in Paragraph 1.05 F above. Employees shall not participate in field activities until they have been trained to a level required by their job function and responsibility.

B. At least one person who has been trained and certified in First Aid and CPR by the American Red Cross or an equivalent organization shall be present on-site during all project operations.

C. Provide a site-specific training session for Contractor personnel scheduled to work on-site. This training shall include a health and safety briefing on the following information:

1. Names of personnel and alternates responsible for site safety and health.

2. Injury, illness, and other hazards present on the site.

3. Safe use of engineering controls and equipment on site.

4. Work practices by which the employee can minimize risks from hazards.

5. Selection, use, care, and maintenance of Personal Protective Equipment (PPE).

6. Site control procedures, including log-in and log-out.

7. Project decontamination procedures.

8. Standard operating safety procedures.

9. Emergency response contingency plan.

D. Develop a training sequence to inform visitors of the hazards associated with the site; to explain emergency procedures; train them in the use of protective gear required during the visit; and to verify they have received, prior to the site visit, the required preliminary training, and medical surveillance examinations.

E. If the project involves the conditions listed in Paragraph 1.04E, maintain documentation on site that the Competent Person(s) has the appropriate training, experience, and authority for that responsibility.

F. If the project involves hazards, equipment, or activities that require licensure by the state in which the work occurs (examples might include welding, rigging, crane operation or asbestos removal), maintain documentation on site that the employees who perform those tasks have the relevant qualifications.

1.08 ACCIDENT OR INCIDENT REPORTS

A. If an accident, an explosion or fire, or a release of toxic materials occurs during the course of the project, notify the Owner by telephone as soon as possible after emergency response agencies have been notified. Send Owner and Engineer written notification within 24 hours.

B. Within 2 working days of any reportable accident, complete and submit to Owner, an accident report addressing the following items:

1. Name, organization, telephone number, and location of the Contractor
2. Name and title of the person(s) reporting.
3. Date and time of the accident/incident.
4. Location of the accident/incident, i.e., site location, facility name.
5. Brief summary of the accident/incident giving pertinent details including type of operation ongoing at the time of the accident/incident
6. Cause of the accident/incident, if known
7. Casualties (fatalities, disabling injuries).
8. Details of any existing chemical hazard or contamination.
9. Estimated property damage, if applicable.
10. Nature of damage, effect on contract schedule.
11. Action taken by Contractor to ensure safety and security.
12. Other damage or injuries sustained, public or private.

1.09 HEALTH AND SAFETY PLAN

A. Prepare a Health and Safety Plan (H&SP) that addresses (at minimum) each concern mentioned in this Section. The H&SP shall be site-specific and shall include measures Contractor and subcontractor(s) will take to control physical, radiological, and chemical hazards associated with

the project. Contractor's standard policies may constitute much of this H&SP. Contractor's HSO shall sign and date the H&SP.

B. The H&SP shall include measures to be taken by Contractor and subcontractor(s) to control physical and chemical hazards associated with work at this site. The Contractor's Health and Safety Program shall address accident prevention and methods of avoiding physical hazards present at this site. The program shall address, at a minimum, the following items:

1. Safety Organization
2. Fire Prevention and Protection
3. Walking and Working Surfaces
4. Site Housekeeping
5. Mechanical Equipment & Inspection
6. Analysis of and controls for the tasks associate with the project, including
   a. Grubbing and clearing,
   b. Trenching and excavation
   c. Demolition
   d. Utility work
   e. Work at elevations
7. Sanitation
8. Daily Safety Inspections
9. Accident Reporting
10. Personal Protection (including respiratory) programs, (if applicable)

C. The H&SP shall address accident prevention and methods for avoiding the physical hazards, such as manholes. The accident prevention section shall address, at a minimum, the following items:

1. Safety Meetings
2. Fire Prevention and Protection
3. Walking and Working Surfaces
4. Site Housekeeping
5. Mechanical Equipment Inspection
6. Sanitation
7. Daily Safety Inspections
8. Accident Reporting

D. Submit the H&SP to Owner and Engineer at or prior to the Pre-Construction Conference. Owner, not Engineer, will review and return it to Contractor with comments. Incorporate Owner's comments and re-submit the H&SP. This review cycle will continue until the Owner gives notice to proceed with the project. At that time, indicate commitment to following the H&SP by an affidavit, signed by the Health and Safety Officer.

E. Notify Owner, in writing, of any modification of any provision of the H&SP. Do not implement the modification until Owner comments on the change.

F. Quickly notify Owner, both verbally and in writing, of any unforeseen hazard, safety related factor, or condition they observe during the work at this site. In the interim, take prudent action to establish and maintain safe working conditions and to safeguard employees, the public, and the environment in accordance with the Health and Safety Plan.

1.10 SITE - SPECIFIC EQUIPMENT PRACTICES

A. Personnel shall wear protective equipment specified in the H&SP for each on-site task. All equipment shall carry applicable MSHA/NIOSH approvals. Contractor's H&SP shall state specific equipment requirements. Contractor may require employees to pay for their safety gear only when that gear can be used off the job.

B. Maintain a sufficient supply of PPE for two Owner employees per day for the duration of the project. Owner will provide respiratory protection and safety shoes for its representatives.

C. Assign personnel to an area or a task for which a respirator might be required only if they have passed a fit test with the make and model of respirator in use. Respirators shall not be interchanged between workers without cleaning and sanitizing. Canisters and filters shall be changed daily.

D. Prescription eyeglasses worn on site must meet ANSI Z87.1. Provide prescription lens inserts for employees who need to wear full face respirators.

E. Require personnel to wear the protective equipment specified in the safety programs and plans.

F. All personal protective equipment worn on-site shall be decontaminated or properly disposed of at the end of each work day.

G. Operations under this Contract will require work exposure to potentially hazardous materials. The Contractor shall, therefore, provide and assure the wearing of all necessary personal protective equipment (PPE) for its on-site personnel. All personnel entering the work area shall don, at a minimum, Level D PPE.

H. The initial minimum level of protection for each major site activity shall be described in the H&SP. Conform to the initial level of protection unless an upgrade or downgrade is warranted by air monitoring data and an evaluation of work practices/controls.

I. Downgrade his level of protection only when 1) the Site Health and Safety Coordinator (SHSC) makes the change based on site activity, air monitoring of contaminant levels, and work place practices as specified in the H&SP or 2) the Certified Industrial Hygienist (CIH) approves the change with the knowledge of the Engineer.

J. The H&SP shall include a written respirator policy which meets 29 CFR 1910.134 and establishes procedures to assure daily cleaning and maintenance of respirators. Breathing air shall be Compressed Gas Association Grade D or better. Cartridges and filters shall be changed at least daily. Respirators and filter cartridges shall be stored in a place and manner that they cannot become contaminated with hazardous materials.

K. Employees shall perform negative pressure fit-checks in accordance with manufacturers' recommendations on air purifying respirators each time they are put on. No facial hair which interferes with a satisfactory fit of a respiratory mask-to-face-seal is allowed on personnel required to wear respiratory protective equipment. A "two-day" growth of beard is considered to interfere with the fit of the respirator.

1.11 STANDARD SAFETY OPERATING PROCEDURES

A. Maintain a set of Standard Safety Operating Procedures to be implemented for this project. Personnel shall observe the following contamination control rules while on-site.

1. Eating, drinking, smoking, chewing gum or tobacco, and other practices that increase the probability of hand-to-mouth transfer and ingestion of material is prohibited in any area designated contaminated.

2. Hands and face shall be thoroughly washed upon leaving the work area and before eating, drinking, urinating, or other activities.

3. Whenever decontamination procedures for protective clothing is in effect, the entire body shall be thoroughly washed as soon as possible after the protective clothing is removed.

4. Medicine and alcohol can increase the effects of exposure to toxic chemicals. Therefore:

a. Personnel using prescription drugs shall inform the doctor who prescribed them of their potential contact with toxic materials;

b. Personnel who take over-the-counter drugs within a day before work on a site must inform the SHSC of the warnings listed on the drug's container (the part of the label that says, for example, "Do not take this medication if you are operating a motor vehicle");

c. Alcoholic beverage intake will be prohibited during project operations. Personnel under the influence of alcohol or recreational or illegal drugs will not be allowed on site.

1.12 GENERAL HEALTH AND SAFETY CONCERNS

A. Each work day, Contractor's SHSC shall inspect the site and the work practices followed on the site to determine whether the H&SP is being followed.

B. When the work area temperatures exceeds 80 degrees F (75 degrees F when workers wear synthetic coveralls), Contractor shall take steps to control heat stress among site personnel. When temperatures are lower than 32 degrees F, Contractor shall take steps to control cold stress among site personnel. Such steps should include; dry layered clothing, break shelters, and provision of heaters.

C. Electrical installations and appliances used by Contractor shall meet applicable 1993 National Electrical Code Standards. All electrical devices utilized by the Contractor or his subcontractors on this project shall be grounded or equipped with and utilize ground fault circuit interrupter (GFCI) protected outlets or extension cord sets. Electrical devices used in confined spaces that may contain flammable vapors shall be explosion proof.

1.13 ENVIRONMENTAL REGULATIONS

A. Establish a system to control access to hazardous work areas by persons who do not need to enter.

B. Conduct operations and maintain site work areas so as to minimize the creation and dispersion of contaminants, dust, and sediment.

C. Wastes, including wash water and storm water, shall be disposed as required by State and Federal regulations.

1.14 EXPOSURE MONITORING

A. Exposure monitoring shall be addressed in the H&SP. The exposure monitoring plan shall be designed to:

1. Detect and quantify the contaminants and physical agents that may be a concern during activities.

2. Provide enough information to allow the site health and safety coordinator to recognize conditions that require changes in work practices or level of protection.

3. Provide enough information to allow the site health and safety coordinator to recognize conditions that expose off-site populations to contaminants (including soil dust) or physical agents released during work activities.

B. Provide all required exposure monitoring equipment and analysis. This equipment shall be operated only by personnel who have been trained in its use. Maintain and calibrate the equipment according to the manufacturer's instructions.

C. Record exposure measurements and make them available to the Owner and Engineer upon request.

1.15 EMERGENCY PREPAREDNESS

A. In the event of a fire or sudden release of contaminants, personnel shall quickly evacuate the area. Contractor's H&SP must document procedures Contractor will follow in the case of an injury or gross contaminant exposure.

B. The plan for on-site and off-site emergencies shall address, at a minimum:

1. Pre-Emergency planning
2. Personnel roles, lines of authority, training, and communication
3. Emergency contact names and telephone numbers:
   - Medical treatment facility and physician
   - Ambulance service's telephone number
   - Fire department's telephone number
   - Police department's telephone number
   - USEPA and state spill control phone numbers
   - Engineer telephone number
   - Owner telephone number
4. Emergency recognition and prevention
5. Emergency alerting and response procedures
6. Evacuation routes and procedures
7. Safe distances and places of refuge
8. Specific procedures for handling personnel with excessive exposure to contaminated soils or materials

9. Personal protective equipment and emergency equipment
10. Emergency personnel and equipment decontamination
11. Emergency medical treatment and first aid
12. Directions to a nearby medical treatment facility
13. Site security and control for incidents
14. Procedures for dealing with fires, explosions, spills
15. Critique of response and follow-up

C. In the event of any emergency associated with this project, Contractor shall without delay alert the Engineer as soon as possible after notifying the emergency response agencies; and institute whatever measures which might be necessary to prevent any repetition of the conditions or actions leading to, or resulting in, the emergency.

D. In the event of an injury or illness among the site personnel, the certified first aid practitioner on-site will take control. The injured or ill person will be transferred to the medical facility designated in the H&SP.

E. When an evacuation is necessary, all field team members will go to the reassembly point for that portion of the site. The H&SP shall identify the reassembly points for Contractor personnel in an evacuation.

F. The H&SP shall identify the method by which personnel will communicate in the event of an emergency. Communications with the office trailer, if it is outside vocal range, normally occur by radio. Communications between Contractor and other organizations normally occur over the telephone. A list of emergency telephone numbers must appear in the H&SP.

G. Provide appropriate emergency equipment, including an industrial-type first aid kit that is approved by its consulting physician for injuries and illnesses which may occur on site. A 20-pound ABC-rated fire extinguisher shall be maintained on-site. Emergency retrieval equipment shall be provided for each confined space entry.

H. All site support vehicles shall be equipped with route maps providing directions to the medical treatment facility. All drivers of the support vehicles shall become familiar with the emergency route and the travel time required at the beginning of project operations.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION

Attachment 1

PHYSICIAN'S CERTIFICATION FOR EMPLOYEES

Name_____ Date of Exam_____

Firm_____

WORK ASSIGNMENT:

This is to certify that I, the undersigned licensed physician, have supervised a physical examination consistent with the requirements of OSHA 29 CFR 1910.120 for the above named individual for the above stated work assignment. I hereby certify that this individual is, in my opinion (complete 1, 2, and 3):

1. ( ) medically qualified to perform the stated work assignment.
   ( ) not medically qualified to perform the stated work assignment.

2. ( ) medically qualified to use respiratory protective devices for the stated work assignment.
   ( ) not medically qualified to use respiratory protective devices for the stated work assignment.

3. ( ) NO RESTRICTIONS
   ( ) RESTRICTIONS: Summarize below or attach summary.

Doctor's Signature_____

Printed Name_____

Address _____

Phone _____

SECTION 01200

PROJECT MEETINGS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Engineer shall schedule and administer a pre-construction conference, pre-installation meetings, periodic progress meetings, and specially called meetings throughout progress of the work. The Engineer shall:

1. Prepare agenda for meetings.
2. Make physical arrangements for meetings.
3. Preside at meetings.
4. Keep a record of the meeting, to include significant proceedings and decisions.
5. Reproduce and distribute copies of the record within five working days after each meeting.
   a. To participants in the meeting.
   b. To parties affected by decisions made at the meeting.

B. Representatives of contractors, subcontractors and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.

C. The Contractor shall attend meetings to ascertain that work is expedited consistent with Contract Documents and construction schedules.

1.02 RELATED REQUIREMENTS

A. Section 00700: General Conditions.

B. Section 00800: Supplementary Conditions.

C. Section 01300: Shop Drawings, Product Data, and Samples.

D. Section 01310: Construction Schedules.

E. Section 01720: Project Record Documents

1.03 PRE-CONSTRUCTION CONFERENCE

A. The Engineer will schedule a pre-construction conference at the Project site or other convenient location no later than 10 days after execution of the Agreement and prior to commencement of construction activities.

B. Location: A central site, convenient for all parties, designated by the Owner.

C. Attendance:

1. Owner's Representative.
2. Engineer.
3. Resident Project Representative.
4. Contractor's Superintendent.
5. Major Subcontractors.
6. Major suppliers.
7. Utilities
8. Others as appropriate.

D. Agenda:

1. Distribution and discussion of:
   a. List of major subcontractors and suppliers.
   b. Projected Construction Schedules.
2. Critical work sequencing.
3. Major equipment deliveries and priorities.
4. Project Coordination.
   a. Designation of responsible personnel.
5. Procedures and processing of:
   a. Field decisions.
   b. Proposal requests.
   c. Submittals.
   d. Change Orders.
   e. Applications for Payment (monthly date of Payment to be determined).
6. Adequacy of distribution of Contract Documents.
7. Procedures for maintaining Record Documents.
8. Use of premises:
   a. Office, work and storage areas.
   b. Owner's requirements.
9. Construction facilities, controls and construction aids.
10. Temporary utilities.
11. Housekeeping procedures.

1.04 PRE-INSTALLATION CONFERENCES

A. The Engineer shall conduct a pre-installation conference at the site before each construction activity that requires coordination with other construction (i.e., HDPE geomembrane liner, protective soil layer, etc.). The Contractor, Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting.

1. Contractor shall review the progress of other construction activities and preparations for the particular activity under consideration at each pre-installation conference, including requirements for:

   a. Contract Documents, including Change Orders.
   b. Purchases and deliveries.
   c. Shop Drawings, Product Data and quality control Samples.

d. Possible conflicts or compatibility problems.
e. Time schedules.
f. Weather limitations.
g. Manufacturer's recommendations.
h. Acceptability of substrates.
i. Space and access limitations.
j. Governing regulations, including safety.
k. Required performance results, inspection and testing requirements.
l. Recording requirements.

2. The Engineer shall record significant discussions and agreements and disagreements of each conference, along with the approved schedule. Distribute the record of the meeting to everyone concerned.

3. Do not proceed if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene the conference at the earliest feasible date.

1.05 PROGRESS MEETINGS

A. The Engineer will schedule regular progress meetings. The progress meetings will be held approximately every 14 to 30 days with the first meeting 14 days after the pre-construction conference or no later than 30 days after the date of Notice to Proceed.

B. Engineer, Owner, or Contractor may hold or call meetings as required by progress of the work.

C. Location of the meetings: Designated by Owner.

D. Attendance:

1. Owner's Representative
2. Engineer and his professional consultants as needed.
3. Resident Project Representative
4. Contractor's Superintendent
5. Subcontractors as appropriate to the agenda.
6. Suppliers as appropriate to the agenda.
7. Others as appropriate.

E. Agenda:

1. Review, approval of minutes of previous meeting.
2. Review of work progress since previous meeting.
3. Field observations, problems and conflicts.
4. Problems which impede Construction Schedule.
5. Review of off-site fabrication, delivery schedules.
6. Measures and procedures to maintain projected schedule.
7. Revisions to Construction Schedule.
8. Progress, schedule, during succeeding work period.
9. Coordination of schedules.
10. Review submittal schedules; expedite as required.

11. Maintenance of quality standards.
12. Pending changes and substitutions.
13. Review proposed changes for:
    a. Effect on Construction Schedule and on completion date.
    b. Effect on other contracts of the Project.
14. Other business.
15. Construction schedule.
16. Critical/long lead items.

F. The Contractor is to attend progress meetings and is to study previous meeting minutes and current agenda items, in order to be prepared to discuss pertinent topics such as deliveries of materials and equipment, progress of the work, etc.

G. The Contractor is to provide a current submittal log at each progress meeting in accordance with Section 01300.

H. The Contractor is to provide a current Construction Schedule at each progress meeting in accordance with Section 01310.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION

SECTION 01300

SHOP DRAWINGS, PROJECT DATA, AND SAMPLES

PART 1 GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

A. This Section specifies the general methods and requirements of submissions applicable to the following work-related submittals: Shop Drawings, Product Data, and Samples. Detailed submittal requirements are specified in the technical specifications sections.

B. All submittals shall be clearly identified by reference to Specification Section, Paragraph, Drawing No. or Detail as applicable. Submittals shall be clear and legible and of sufficient size for sufficient presentation of data.

1.02 SCHEDULE OF SUBMITTALS

A. Prepare a complete schedule of submittals.

1. Coordinate Schedule of Submittals with the list of subcontractors, schedule of values, product listing, as well as the Contract construction schedule.

2. Prepare the schedule in chronological order. Provide the following information for each submittal:

   a. Submittal category and name.
   b. Name of Contractor, if applicable.
   c. Brief description of the part of the Work covered.
   d. Related Section number.
   e. Scheduled date for delivery of submittal to Engineer
   f. Scheduled date for the Engineer's final review of submittal.

3. Prepare the Schedule of Submittals with columns for recording actual dates of submittal processing.

B. Distribution: Following response to initial submittal, print and distribute copies to the Engineer, Owner, subcontractors, suppliers and other parties who are required to comply with submittal dates indicated. Post copies in the Project meeting room and field office.

1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

C. Updating Schedule of Submittals: Revise the schedule after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting.

1.03 SHOP DRAWINGS, PRODUCT DATA, SAMPLES

A. Shop Drawings

1. Shop drawings, as defined in the General Conditions, and as specified in individual work Sections include, but are not necessarily limited to, custom-prepared data such as fabrication and erection/installation (working) drawings, scheduled information, setting diagrams, actual shopwork manufacturing instructions, custom templates, special wiring diagrams, coordination drawings, individual system or equipment inspection and test reports including performance curves and certifications, as applicable to the Work. **Standard Product information prepared without specific reference to Project requirements will not be considered a shop drawing.**

2. All shop drawings submitted by subcontractors for approval shall be sent directly to the Contractor for checking. The Contractor shall be responsible for their submission at the proper time so as to prevent delays in delivery of materials.

3. The Contractor shall check all subcontractor's shop drawings regarding measurements, size of members, materials, and details to satisfy himself that they conform to the intent of the Drawings and Specifications. Shop drawings found to be inaccurate or otherwise in error shall be returned to the subcontractors for correction before submission thereof.

4. All details on shop drawings submitted for approval shall show clearly the relation of the various parts to the main members and lines of the structure, and where correct fabrication of the work depends upon field measurements, such measurements shall be made and noted on the drawings before being submitted for approval.

5. Submittals for equipment specified under Divisions 11, 15 and 16 shall include a listing of all installations where identical or similar equipment has been installed and been in operation for a period of at least one year.

6. Facsimiles or copies of facsimiles will not be accepted for review.

B. Product Data

1. Product data as specified in individual Sections, include, but are not necessarily limited to, standard prepared data for manufactured products (sometimes referred to as catalog data), such as the manufacturer's product specification and installation instructions, availability of colors and patterns, manufacturer's printed statements of compliances and applicability, roughing-in diagrams and templates, catalog cuts, product photographs, standard wiring diagrams, printed performance curves and operational-range diagrams, production or quality control inspection and test reports and certifications, mill reports, product operating and maintenance instructions and recommended spare-parts listing and printed product warranties, as applicable to the Work.

2. Facsimiles or copies of facsimiles will not be accepted for review.

C. Working Drawings

1. When used in the Contract Documents, the term "working drawings" shall be considered to mean the Contractor's plans for temporary structures such as temporary bulkheads, support of open cut excavation, support of utilities, ground water control systems, forming and falsework; and for such other work as may be required for construction but does not become an integral part of the Project.

2. Working drawings shall be prepared and sealed by a registered Professional Engineer, currently licensed to practice in the State of North Carolina. The Contractor shall submit a letter of certification from the Professional Engineer stating that he/she has prepared the designs and has verified that the materials/ equipment have been installed as designed. No working drawings or calculations/computations relating to the working drawings shall be submitted to the Engineer unless specifically requested in writing.

D. Samples

1. Samples specified in individual Sections, include, but are not necessarily limited to, physical examples of the work such as sections of manufactured or fabricated work, small cuts or containers of materials, complete units of repetitively-used products, color/texture/pattern swatches and range sets, specimens for coordination of visual effect, graphic symbols and units of work to be used by the Engineer or Owner for independent inspection and testing, as applicable to the Work.

1.04 CONTRACTOR'S RESPONSIBILITIES

A. The Contractor shall review shop drawings, product data and samples, including those by subcontractors, prior to submission to determine and verify the following:

1. Field measurements
2. Field construction criteria
3. Catalog numbers and similar data
4. Conformance with the Specifications

B. Each shop drawing, sample and product data submitted by the Contractor shall have affixed to it the following Certification Statement including the Contractor's Company name and signed by the Contractor: "Certification Statement: By this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data and I have checked and coordinated each item with other applicable approved shop drawings and all Contract requirements." Shop drawings and product data sheets 11-in x 17-in and smaller shall be bound together in an orderly fashion and bear the above Certification Statement on the cover sheet. The cover sheet shall fully describe the packaged data and include a listing of all items within the package.

C. The Contractor shall utilize a 10-character submittal identification numbering system in the following manner:

1. The first character shall be a D, S, P, M, or R, which represents Shop/Working Drawing and other Product Data (D), Sample (S), Preliminary Submittal (P), Operating/Maintenance Manual (M), or Request for Information (R).

2. The next five digits shall be the applicable Specification Section Number.

3. The next three digits shall be the numbers 001-999 to sequentially number each initial separate item or drawing submitted under each specific Section number.

4. The last character shall be a letter, A-Z, indicating the submission, or resubmission of the same Drawing, i.e., "A=1st submission, B=2nd submission, C=3rd submission, etc.

A typical submittal number would be as follows:

D-03300-008-B

D	=	Shop Drawing
03300	=	Specification Section for Concrete
008	=	The eighth initial submittal under this specification section
B	=	The second submission (first resubmission) of that particular shop drawing

D. Notify the Engineer in separate written correspondence, at the time of submittal, of any deviations in the submittals from the requirements of the Contract Documents. **Deviations from the requirements of the Contract Documents included in a submittal reviewed by the Engineer or his consultants are not accepted unless they have been identified by the Contractor in writing and specifically acknowledged as having been reviewed by the Engineer.**

E. The review and approval of shop drawings, samples or product data by the Engineer shall not relieve the Contractor from his/her responsibility with regard to the fulfillment of the terms of the Contract. All risks of error and omission are assumed by the Contractor and the Engineer will have no responsibility therefor.

F. No portion of the work requiring a shop drawing, sample, or product data shall be started nor shall any materials be fabricated or installed prior to the approval or qualified approval of such item. Fabrication performed, materials purchased or on-site construction accomplished which does not conform to approved shop drawings and data shall be at the Contractor's risk. The OWNER will not be liable for any expense or delay due to corrections or remedies required to accomplish conformity.

G. Project work, materials, fabrication, and installation shall conform with approved shop drawings, applicable samples, and product data.

1.05 SUBMISSION REQUIREMENTS

A. Make submittals promptly in accordance with approved schedule, and Schedule of Submittals and in such sequence as to cause no delay in the Work or in the work of any other Contractor.

B. The Contractor shall submit to the Engineer all shop drawings and data sufficiently in advance of construction requirements to provide no less than twenty-one (21) calendar days for review from the time the Engineer receives them. No less than thirty (30) calendar days will be required for major equipment that required review by more than one (1) Engineering discipline. Each re-submission of a shop drawing will establish a new 21 or 30 calendar day review period.

C. Number of submittals required:
   1. Shop Drawings as defined in Paragraph 1.03 A: Six copies.
   2. Product Data as defined in Paragraph 1.03 B: Six copies.
   3. Samples: Submit the number stated in the respective Specification Sections.

D. Submittals shall contain:

   1. The date of submission and the dates of any previous submissions.
   2. The Project title and number.
   3. Contractor identification.
   4. The names of:
      a. Contractor
      b. Supplier
      c. Manufacturer
   5. Identification of the product, with the specification section number, page and paragraph(s).
   6. Field dimensions, clearly identified as such.
   7. Relation to adjacent or critical features of the Work or materials.
   8. Applicable standards, such as ASTM or Federal Specification numbers.
   9. Identification of deviations from Contract Documents.
   10. Identification of revisions on resubmittals.
   11. An 8-in x 3-in blank space for Contractor and Engineer stamps.

1.06 REVIEW OF SHOP DRAWINGS, PRODUCT DATA, WORKING DRAWINGS AND SAMPLES

A. The review of shop drawings, data, and samples will be for general conformance with the design concept and Contract Documents. They shall not be construed:

   1. as permitting any departure from the Contract requirements;

   2. as relieving the Contractor of responsibility for any errors, including details, dimensions, and materials;

   3. as approving departures from details furnished by the Engineer, except as otherwise provided herein.

B. The Contractor remains responsible for details and accuracy, for coordinating the work with all other associated work and trades, for selecting fabrication processes, for techniques of assembly, and for performing work in a safe manner.

C. If the shop drawings, data or samples as submitted describe variations and show a departure from the Contract requirements which Engineer finds to be in the interest of the Owner and to be so minor as not to involve a change in Contract Price or time for performance, the Engineer may return the reviewed drawings without noting an exception.

D. Submittals will be returned to the Contractor under one of the following codes.

Code 1 - "APPROVED" is assigned when there are no notations or comments on the submittal. When returned under this code the Contractor may release the equipment and/or material for manufacture.

Code 2 - "APPROVED AS NOTED" - This code is assigned when a confirmation of the notations and comments IS NOT required by the Contractor. The Contractor may release the equipment or material for manufacture; however, all notations and comments must be incorporated into the final product.

Code 3 - "APPROVED AS NOTED/CONFIRM" - This combination of codes is assigned when a confirmation of the notations and comments IS required by the Contractor. The Contractor may, at his own risk, release the equipment or material for manufacture; however, all notations and comments must be incorporated into the final product. This confirmation shall specifically address each omission and nonconforming item that was noted. Confirmation is to be received by the Engineer within [15] calendar days of the date of the Engineer's transmittal requiring the confirmation.

Code 4 - "APPROVED AS NOTED/RESUBMIT" - This combination of codes is assigned when notations and comments are extensive enough to require a resubmittal of the package. This resubmittal is to address all comments, omissions and non-conforming items that were noted. Resubmittal is to be received by the Engineer within [15] calendar days of the date of the Engineer's transmittal requiring the resubmittal.

Code 5 - "NOT APPROVED" is assigned when the submittal does not meet the intent of the Contract Documents. The Contractor must resubmit the entire package revised to bring the submittal into conformance. It may be necessary to resubmit using a different manufacturer/vendor to meet the Contract Documents.

Code 6 - "COMMENTS ATTACHED" is assigned where there are comments attached to the returned submittal which provide additional data to aid the Contractor.

Code 7 - "RECEIPT ACKNOWLEDGED" - This code is assigned to acknowledge receipt of a submittal that is not subject to the Engineer's review and approval; and, is being filed for informational purposes only. This code is generally used in acknowledging receipt of *means and methods of construction* work plan, field conformance test reports, and Health and Safety plans.

Codes 1 through 5 designate the status of the reviewed submittal with Code 6 showing there has been an attachment of additional data.

E. Resubmittals will be handled in the same manner as first submittals. On resubmittals the Contractor shall direct specific attention, in writing on the letter of transmittal and on resubmitted shop drawings by use of revision triangles or other similar methods, to revisions other than the corrections requested by the Engineer, on previous submissions. Any such revisions which are not clearly identified shall be made at the risk of the Contractor. The Contractor shall make corrections to any work done because of this type revision that is not in accordance to the Contract Documents as may be required by the Engineer.

F. Partial submittals may not be reviewed. The Engineer will be the only judge as to the completeness of a submittal. Submittals not complete will be returned to the Contractor, and will be considered "Not Approved" until resubmitted. The Engineer may at his/her option provide a list or mark the submittal directing the Contractor to the areas that are incomplete.

G. Repetitive Review

1. Shop drawings and other submittals will be reviewed no more than twice at the Owner's expense. All subsequent reviews will be performed at times convenient to the Engineer and at the Contractor's expense, based upon a flat rate of $120.00 per hour. The Contractor shall reimburse the Owner for all such fees invoiced to the OWNER by the Engineer. Submittals are required until approved.

2. Any need for more than one resubmission, or any other delay in obtaining Engineer's review of submittals, will not entitle Contractor to extension of the Contract Time.

H. If the Contractor considers any correction indicated on the shop drawings to constitute a change to the Contract Documents, the Contractor shall give written notice thereof to the Engineer at least seven working days prior to release for manufacture.

I. When the shop drawings have been completed to the satisfaction of the Engineer, the Contractor shall carry out the construction in accordance therewith and shall make no further changes therein except upon written instructions from the Engineer.

J. Request for Information (RFI) shall be submitted on a standard form provided by the Engineer. RFIs shall indicate their importance to the timely completion of the project. RFIs will be processed as a shop drawing unless there is an urgent need for immediate response.

1.07 DISTRIBUTION

A. Number of approved shop drawing copies distributed to the Contractor by the Engineer shall not exceed 4.

1.08 PROFESSIONAL ENGINEER (P.E.) CERTIFICATION FORM

A. If specifically required in other Sections of these Specifications, the Contractor shall submit a P.E./P.L.S. Certification for each item required, in the form attached to this Section, completely filled in and stamped.

1.09 GENERAL PROCEDURES FOR SUBMITTALS

A. Coordination of Submittal Times: Prepare and transmit each submittal sufficiently in advance of performing the related work or other applicable activities, or within the time specified in the individual work sections, of the Specifications, so that the installation will not be delayed by processing times including disapproval and resubmittal (if required), coordination with other submittals, testing, purchasing, fabrication, delivery and similar sequenced activities. No extension of time will be authorized because of the Contractor's failure to transmit submittals sufficiently in advance of the Work.

END OF SECTION

P.E./P.L.S. CERTIFICATION FORM

The undersigned hereby certifies that he/she is a Professional Engineer/Professional Land Surveyor registered in the State of North Carolina and that he/she has been employed by (Name of Contractor) _____ to design ___ _____in accordance with Specification Section _____for the (Name of Project) _____.

The undersigned further certifies that he/she has performed the said design in conformance with all applicable local, state and federal codes, rules, and regulations, and that his/her signature and P.E./P.L.S. stamp have been affixed to all calculations and drawings used in, and resulting from, the design.

The undersigned hereby agrees to make all original design drawings and calculations available to Cabarrus County or Owner's representative within five working days following written request therefor by the Owner.

_____
P.E./P.L.S. Name

_____
Signature

_____
Address

_____
Contractor's Name

_____
Signature

_____
Title

_____
Address

SECTION 01310

CONSTRUCTION SCHEDULES

PART 1 GENERAL

1.01 GENERAL

A. Construction under this Contract must be coordinated to assure that construction is completed within the time allowed by the Contract Documents. The Contractor shall also coordinate his activities with the other contractors to allow orderly and timely completion of all the work.

B. When access through interface and/or overlapping construction areas must be disrupted, the Contractor shall provide alternate acceptable access for other contractors.

C. The Contractor is required to coordinate his activities in the interface or common areas with these other Contractors and the facility operators. The Contractor must submit to the Engineer a description and schedule as to how the common areas will be utilized, recognizing the required coordination with other contractors and the Owner.

1.02 CONSTRUCTION SCHEDULING GENERAL PROVISIONS

A. No work shall be done between 7:00 P.M. and 7:00 A.M. or on Sundays or legal holidays without the written permission of the Owner. However, emergency work may be done without prior permission.

B. Night work may be established by the Contractor as acceptable procedure with the written permission of the Owner. Such permission, however, may be revoked at any time by the Owner if the Contractor fails to maintain adequate equipment and supervision for the proper execution and control of the work at night.

C. The Contractor shall be fully responsible for providing all temporary piping, plumbing, electrical hook-ups, heating, ventilating, air conditioning, lighting, temporary structure, or whatever is required to maintain existing landfill operations. All details of temporary piping and temporary construction are not necessarily shown on the Plans or covered in the Specifications. However, this does not relieve the Contractor of the responsibility to insure that construction will not interrupt daily operations at the landfill.

D. The Contractor shall have the capability of preparing and utilizing the specified critical path method/schedule (CPM) scheduling technique. A statement of CPM capability shall be submitted in writing to the Engineer within ten calendar days of Notice of Award of the Contract and will verify that either the Contractor's organization has the in-house capability qualified to use the technique or that the Contractor employs a consultant who is so qualified. Capability shall be verified by description of the construction projects to which the Contractor or his consultant has successfully applied the CPM scheduling technique which shall include at least two (2) projects valued at the Bid price of this Project and at least one PROJECT which was controlled throughout the duration of the Project by means of systematic use and updating of a computer-based CPM schedule. The submittal shall include the name of the individual on the CONTRACTOR's staff

who will be responsible for the CPM schedule and for providing the required updating information.

1.03 PROGRESS OF THE WORK

A. The work shall be executed with such progress as may be required to prevent any delay to the general completion of the work. The work shall be executed at such times and in or on such parts of the Project, and with such force, materials and equipment to assure completion of the work in the time established by the Contract.

B. If the Contractor for his convenience and at his own expense, should desire to carry on his work outside regular working hours, he shall submit written notice to the Engineer and he shall allow ample time for the satisfactory arrangement to be made for inspecting the work in progress. The Contractor shall reimburse the Owner for extra inspection required for work outside regular working hours (as defined in SC-7.36).

PART 2 PROGRESS SCHEDULE SUBMITTALS

2.01 GENERAL REQUIREMENTS

A. The Contractor shall submit a critical path schedule (CPM) as described herein.

B. The critical path schedule requirement will consist of estimated and preliminary progress schedules, monthly progress status reports (Monthly Status Reports), an as-built schedule report, and revisions to the schedules and analyses as prescribed. The planning, scheduling, management, and execution of the work is the sole responsibility of the Contractor. The progress schedule requirement is established to allow Engineer to review Contractor's planning, scheduling, management and execution of the work; to assist Engineer in evaluating work progress and make progress payments; to allow other contractors to cooperate and coordinate their activities with those of the Contractor; and to provide Owner with information about "construction schedule" and "cumulative outlay schedule".

C. The current Schedule, if concurred by Owner, shall have legal status as long as it is used by Contractor for planning, organizing, directing, managing, and executing the work in accordance with the Contract Documents. Legal status will further imply that Contractor will use the schedule to report progress and, further, that Contractor and Owner will use the schedule for determining delay(s) in achieving the Contract date(s) stipulated in the Contract subject to the requirements of this section of the General Requirements.

D. Engineer will, upon receipt and review of each schedule submittal, either indicate in writing a recommendation of concurrence and present the submittal to Owner, or return the submittal to Contractor indicating in writing Engineer's reasons for refusing to recommend concurrence. In the latter case, Contractor will be required to make the necessary corrections and resubmit. If Contractor fails to provide submittals as required, he/she will be deemed not to have provided a basis upon which progress may be evaluated, which may constitute reasons for refusing to recommend progress payments.

E. Engineer's review of the schedule submittals shall be only for conformance with the information given in the Contract Documents and shall not extend to the means, methods, sequences and techniques or procedures of construction or to safety precautions or programs incident thereto.

Engineer's review of the schedule submittals will be predicated on a Contractor's stamp of approval signed off by Contractor and those subcontractors and suppliers performing work under an appropriate agreement with Contractor. Contractor's stamp of approval on any schedule submittal shall constitute a representation to Owner and Engineer that Contractor has either determined or verified all data on the submittal, or assumes full responsibility for doing so, and that Contractor and his subcontractors and suppliers, have reviewed and coordinated the sequences shown in the submittal with the requirements of the work under the Contract Documents.

2.02 FORM OF SCHEDULES

A. Upon concurrence, prepare schedules in the form of a horizontal bar chart diagram. The diagram shall be time scaled and sequenced by work areas. Horizontal time scale shall identify the first work day of each week.

B. Activities shall be at least as detailed as the Schedule of Prices (Section 00300). Activity durations shall be in whole working days. In addition, activity man-days shall be shown for each activity or alternatively tabulated in an accompanying report.

C. Diagrams shall be neat and legible and submitted on sheets at least 11 inches by 17 inches suitable for reproduction. Scale and spacing shall allow space for notations and future revisions.

D. The program disk, the diagrams and reports shall be prepared by using Primavera SureTrak® (3.0), Microsoft Project 2007 or latest version.

E. A copy of the schedule project files shall be prepared. Furnish this information on CD for each submittal.

2.03 CONTENT OF SCHEDULES

A. Each monthly schedule shall be based on data as of the last day of the current pay period.

B. Description of each activity shall be brief but convey the scope of work described.

C. Activities shall identify all items of work that must be accomplished to achieve substantial completion, such as items pertaining to Contractor's installation and testing activities; items pertaining to the approval of regulatory agencies; Contractor's time required for submittals, fabrication and deliveries; the time required by Engineer to review all submittals as set forth in the Contract Documents, items of work required of Owner to support pre-operational, start-up and final testing; time required for the relocation of utilities. Activities shall also identify interface milestones with the work of other contractors performing work under separate contracts with Owner.

D. Schedules shall show the complete sequence of construction by activities. Dates for beginning and completion of each activity shall be indicated as well as projected percentage of completion for each activity as of the first day of each month.

E. Submittals schedule for shop drawing review, product data, and samples shall show the date of Contractor submittal and the date approved submittals will be required by the Engineer, consistent with the time frames established in the Specifications.

F. For Contract change orders granting time extensions, the impact on the Contract date(s) shall equal the calendar-day total time extension specified for the applicable work in the Contract change order.

G. For actual delays, add activities prior to each delayed activity on the appropriate critical path(s). Data on the added activities of this type shall portray all steps leading to the delay, and shall further include the following: separate activity identification, activity description indicating cause of delay, activity duration consistent with whichever set of dates below applies, the actual start and finish dates of the delay or, if the delay is not finished, the actual start date and estimated completion date.

H. For potential delays, add an activity prior to each potentially delayed activity on the appropriate critical path(s). Data for added activities of this type shall include alternatives available to mitigate the delay including acceleration alternatives, and further show the following: separate activity identification, activity description indicating cause of the potential delay, and activity duration equal to zero work days.

I. The Contract completion time will be adjusted only for causes specified in this Contract. In the event the Contractor requests an extension of any Contract completion date, he shall furnish such justification and supporting evidence as the Engineer may deem necessary for a determination as to whether the Contractor is entitled to an extension of time under the provisions of the Contract. Engineer will, after receipt of such justification and supporting evidence make findings of act and will advise the Contractor in writing thereof. If the Engineer finds that the Contractor is entitled to any extension of any Contract completion date under the provisions of this Contract, the Engineer's determination as to the total number of days extension shall be based upon the currently concurred schedule and on all data relevant to the extension. Such data shall be included in the next monthly updating of the schedule. The Contractor acknowledges and agrees that actual delays in the activities which, according to the schedule, do not affect any Contract completion data shown by the critical path in the schedule and do not have any effect on the Contract completion date or dates, and therefore, will not be the basis for a change therein.

J. From time to time, it may be necessary for the Contract schedule and/or completion time to be adjusted by the Engineer to reflect the effects of job conditions, weather, technical difficulties, strikes, excusable delays on the part of the Owner or his representatives, and other unforeseeable conditions which may indicate schedule adjustments and/or completion time extension. Under such conditions, the Contractor shall reschedule the work and/or Contract completion time to reflect the changed conditions, and the Contractor shall revise his schedule accordingly. No additional compensation shall be made to the Contractor for such schedule changes for excusable overall Contract time extension beyond the actual completion of all unaffected work in the Contract, in which case the Contractor shall take all possible action to minimize any time extension and any additional cost to the Owner. It is specifically pointed out that the use of available float time in the schedule may be used by the Owner as defined by the Engineer, as well as by the Contractor. Float time is defined as the amount of time between the early start date, and the late start date, or the early finish date and the late finish date, of any of the activities in the schedule.

K. The Owner controls the float time in the concurred schedule, and, therefore, without obligation to extend either the overall completion date or any intermediate completion dates set out in the schedule, the Owner may initiate changes to the Contract work that absorb float time only. Owner-initiated changes that affect the critical path on the approved schedules shall be the sole

grounds for extending (or contracting) said completion dates. Contractor-initiated changes that encroach on the float time identified in the concurred schedule may be accomplished with the Owner's concurrence. Such changes, however, shall give way to Owner-initiated changes competing for the same float time.

2.04 SUPPORTING NARRATIVE

A. Status and Scheduling reports identified below shall contain a narrative to document the project status, to explain the basis of Contractor's determination of durations, describe the Contract conditions and restraints incorporated into the schedule, and provide an analysis pertaining to potential problems and practical steps to mitigate them.

B. The narrative shall specifically include:

1. Actual completion dates for activities completed during the quarterly report period, and actual start dates for activities commenced during the quarterly report period.

2. Anticipated start dates for activities scheduled to commence during the following quarterly report period.

3. Changes in the duration of any activity and minor logic changes.

4. The progress along the critical path in terms of calendar days ahead or behind the Contract Date.

5. If the Monthly Status Report indicates an avoidable delay to the Contract Completion date or interim completion dates as specified in the Contract, Contractor shall identify the problem, cause and the activities affected and provide an explanation of the proposed corrective action to meet the milestone dates involved or to mitigate further delays.

6. If the delay is thought to be unavoidable, the Contractor shall identify the problem, cause, duration, specific activities affected and logic restraints of each activity.

7. The narrative shall, in addition, also discuss all change order activities whether included or not in the revised/current schedule of legal status. Newly introduced Change Order work activities, and the CPM path(s) that they affect, must be specifically identified. All Change Order work activities added to the schedule shall conform with the sequencing and Contract Time requirements of the applicable Change Order.

8. Original Contract date(s) shall not be changed except by Contract Change Order. A revision, as specified in Article 3.06 below, need not be submitted when the foregoing situations arise unless required by Engineer. Review of a report containing added activities will not be construed to be concurrence with the duration of restraints for such added activities; instead the corresponding data as ultimately incorporated into the applicable Contract Change Order shall govern.

9. Should Engineer require additional data, this information shall be supplied by Contractor within ten (10) calendar days.

PART 3 EXECUTION

3.01 SUBMITTALS

A. Contractor shall submit Estimated and Preliminary Progress Schedules (as identified in the Instructions to Bidders and the Supplementary General Conditions, Sections 00100 and 00800), monthly status reports, and an as-built schedule report all as specified herein.

B. All schedules, including estimated and preliminary schedules, shall be in conformance with Articles 2.01, 2.02 and 2.03 above.

C. The initial finalized progress schedule shall be the first monthly status report and as such shall be in conformance with all applicable specifications contained herein.

D. Monthly Status Report submittals shall include five copies of a time-scaled (days after Notice-To-Proceed) diagram (color) showing all Contract activities, tabular activity and total float reports, and supporting narrative. The initial detailed schedule shall use the Notice-To-Proceed as the data date. The finalized schedule, if concurred with by Owner pursuant to Paragraph 2.01(C), shall be the work plan to be used by the Contractor for planning, scheduling, managing, and executing the work.

E. The schedule diagram shall be formatted in accordance with Article 2.02 above. The diagram shall include (1) all detailed activities included in the preliminary and estimated schedule submittals, (2) calendar days prior to substantial completion, (3) summary activities for the remaining sixty (60) days.

The critical path activities shall be identified, including critical paths for interim dates, if applicable.

F. Contractor shall submit monthly progress schedules with each month's Application for Payment. Engineer will review schedules and return review copy within ten (10) calendar days after receipt. If required, Contractor shall resubmit within seven (7) calendar days after return of review copy.

G. Contractor shall submit the number of monthly status reports which the Contractor requires, plus five (5) copies which will be retained by the Engineer.

3.02 MONTHLY STATUS REPORTS

A. Contractor shall submit five (5) copies of detailed schedule status reports on a monthly basis with the Application for Payment. The first such status report shall be submitted with the first Application for Payment and include data as of the last day of the pay period. The Monthly Report shall include an "up-dated" copy of the latest detailed schedule of legal status, tabular activity and total float reports, and a supporting narrative including updated information as described in Paragraph 2.04. The Monthly Report will be reviewed by Engineer and Contractor at a monthly schedule meeting, and Contractor will address Engineer's comments on the subsequent monthly report. Monthly status reports shall be the basis for evaluating Contractor's progress.

B. The "up-dated" diagram shall show, for the latest detailed schedule of legal status, percentages of completion for all activities, actual start and finish dates, and remaining durations, as appropriate. Activities not previously included in the latest detailed schedule of legal status shall be added,

except that contractual dates will not be changed except by Change Order. Review of an "Up-dated" diagram by Engineer will not be construed to constitute concurrence with the time frames, duration, or sequencing for such added activities; instead the corresponding data as ultimately incorporated into an appropriate Change Order shall govern.

3.03 STARTUP SCHEDULE

A. At least 90 calendar days prior to the date of substantial completion, Contractor shall submit a time-scaled (days after Notice to Proceed) diagram detailing the work to take place in the period between 60 days prior to substantial completion and substantial completion, together with a supporting narrative. Engineer shall have twenty (20) calendar days after receipt of the submittal to respond. Upon receipt of Engineer's comments, Contractor shall make the necessary revisions and submit the revised schedule within ten (10) calendar days. The resubmittal, if concurred with by Owner, shall be the Work Plan to be used by Contractor for planning, managing, scheduling and executing the remaining work leading to substantial completion.

B. The time-scaled diagram shall use the latest schedule of legal status for those activities completed ahead of the last sixty (60) calendar days prior to substantial completion, and detailed activities for the remaining sixty (60) day period within the time frames outlined in the latest schedule of legal status.

C. Contractor will be required to continue the requirement for monthly reports, as outlined in Article 3.02 above. In preparing this report, Contractor must assure that the schedule is consistent with the progress noted in the startup schedule.

3.04 AS-BUILT SCHEDULE

After substantial completion but prior to final payment, Contractor shall submit as-built schedule report and time-scaled as-built diagram. The documents shall reflect all as-built critical paths. The diagram shall be prepared in accordance with Articles 2.02 and 2.03, in addition to the following:

A. All Contract activities, including all added activities, shall be shown.

B. Activity durations shall be the actual number of separate work days during which work was performed on the activity.

C. Contract milestone completions shall be plotted on the date of the Substantial Completion Reports.

3.05 REVISIONS

A. All revised Schedule Submittals shall be made in the same form and detail as the initial submittal and shall be accompanied by an explanation of the reasons for such revisions, all of which shall be subject to review by Engineer and concurrence by Owner. The revision shall incorporate all previously made changes to reflect current as-built conditions. Minor changes to the approved submittal may be approved at monthly meetings; a minor change is not considered a revision in the context of this paragraph.

B. A revised schedule submittal shall be submitted for review, when required by Engineer, for one of the following reasons:

1. Owner or Engineer directs a change that affects the date(s) specified in the Agreement or alters the length of a critical path.

2. Contractor elects to change any sequence of activities so as to affect a critical path of the current schedule documents.

C. If, prior to agreement on an equitable adjustment to the Contract time, Engineer requires revisions to the schedule in order to evaluate planned progress, Contractor shall provide an interim revised submittal for review with change effect(s) incorporated as directed. Interim revisions to the documents which are recommended to the Owner for concurrence will be incorporated in the next Monthly Status Report.

3.06 CONSTRUCTION PERIOD

A. The Contractor's attention is directed to the form of Contract (Section 00500) which specifies Contract times for the Work.

B. Whenever it becomes apparent from the current monthly progress evaluation and updated schedule data that any milestone and/or Contract completion date will not be met, the Contractor shall take some or all of the following actions:

1. Increase construction manpower in such quantities and crafts as shall subsequentially eliminate the backlog of work;

2. Increase the number of working hours per shift, shifts per work day, work days per week, or the amount of construction equipment, or any combination of the foregoing sufficient to substantially eliminate the backlog of work; and

3. Reschedule work items to achieve concurrence of accomplishment.

C. The addition of equipment or construction forces, increasing the working hours or any other method, manner, or procedure to return to the current Detailed Schedule shall be at the Contractor's own cost and shall not be considered justification for a Change Order or treated as an acceleration order.

D. Failure on the part of the Contractor to take appropriate schedule recovery action as specified above shall constitute grounds for increasing the retention on progress payments.

END OF SECTION

SECTION 01380

CONSTRUCTION PHOTOGRAPHS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall employ a competent photographer to take construction record photographs periodically during course of the Work.

1.02 RELATED REQUIREMENTS

A. Section 01010: Summary of Work.

B. Section 01390: Pre-Construction Photographs

C. Section 01720: Project Record Documents.

1.03 PHOTOGRAPHY REQUIRED

A. Prior to the start of construction, videotape the entire construction site in accordance with Section 01390.

B. Provide two aerial photographs with two different views of landfill expansion construction areas taken on the cutoff date for each scheduled Application for Payment over the duration of the Work.

C. Views and Quantities Required:

1. At each specified time, provide aerial photographs with at least two different views, as approved by the Engineer.

2. Provide four prints of each view.

D. Provide three aerial (oblique) photographs, 24" x 24" masonite board mounted, in color, one to be taken prior to the start of construction, one during multiple synthetics material deployment and one at the completion of the project. Views shall be as approved by the Engineer. Provide two prints of each view.

1.04 COSTS OF PHOTOGRAPHY

A. Pay costs for specified photography and prints.

1. Parties requiring additional photography or prints will pay photographer directly.

PART 2 PRODUCTS

2.01 PRINTS

A. Color:

1. Paper: Single weight, color print paper.
2. Finish: Smooth surface, matte.
3. Size: 11-inch x 14-inch.

B. Identify each print on back, listing:

1. Name of Project.
2. Description of subject and orientation of view.
3. Date and time of exposure.
4. Name and address of photographer.
5. Photographer's numbered identification of exposure.

C. Aerial photographs to be color.

PART 3 EXECUTION

3.01 TECHNIQUE

A. Factual presentation.

B. Correct exposure and focus.

1. High resolution and sharpness.
2. Maximum depth-of-field.
3. Minimum distortion.

3.02 VIEWS REQUIRED

A. Photograph from locations to adequately illustrate condition of construction and state of progress.

1. At successive periods of photography, take at least one photograph from the same overall view as previously.

2. Consult with the Engineer at each period of photography for instructions concerning views required.

3.03 ASSEMBLY OF PRINTS

A. Prints shall be mounted in plastic (non-glare) protectors.

B. Provide a suitably sized 3-ring binder for each set of prints. Binders shall be furnished in sufficient quantities to hold all photographs taken for the duration of the contract. Each binder shall be engraved on the front and spine with the project name.

3.04 DELIVERY OF PRINTS

A. Deliver prints to the Engineer to accompany each Application for Payment.

B. Distribution of prints as soon as processed, is anticipated to be as follows:

1. Owner (one set).

2. Engineer (one set).

3. Project Record File (one set to be stored by Contractor).

4. Contractor (one set).

C. The Contractor shall not be allowed to begin construction until preconstruction photography (video) is completed and submitted to Engineer.

D. All proofs associated with the construction of the Cabarrus County Construction and Demolition Debris Landfill Closure shall become the property of Cabarrus County.

END OF SECTION

SECTION 01390

PRE-CONSTRUCTION PHOTOGRAPHY

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment, and incidentals required to record existing conditions within the construction limits, as shown in the Drawings and as specified herein.

1.02 RELATED WORK (REQUIREMENTS)

A. The Contract Documents include, but are not limited to, the following related requirements:

1. Section 01380: Construction Photographs

2. Section 01720: Project Record Documents

1.03 QUALIFICATIONS

A. The photography shall be done by a competent professional who is fully experienced, and qualified with the specified equipment.

B. The audio shall be done by a person qualified and knowledgeable in the contract requirements, and be able to speak with clarity and diction so as to be easily understood.

1.04 COSTS OF PHOTOGRAPHY

A. The Contractor shall pay all costs for the specified photography and prints.

1. Parties requiring additional photography or prints will pay photographer directly.

1.05 PRECONSTRUCTION AUDIOVISUAL DVD's

A. DVD recordings shall be made within 30 days prior to the start of construction. No construction shall begin prior to review and approval of the DVD recording covering the construction area with the Engineer. The Engineer shall have the authority to reject all or any portion of the recording not conforming to specifications and require that it be redone at no additional charge. The Contractor shall reschedule unacceptable coverage within five days after being notified. The Engineer shall designate those areas, if any, to be omitted from or added to the audiovisual coverage. All DVD's and written records shall become the property of Owner.

B. The Contractor shall engage the services of a professional photographer. The color recording shall be prepared by a responsible commercial firm known to be skilled and regularly engaged in the business of construction color recording. The photographer shall furnish to the Engineer a list of all equipment to be used for recording, (i.e., manufacturer's name, model number, specifications, and other pertinent information). Additional information to be furnished by the

photographer shall include the names and addresses of two references that the photographer has performed color recording for projects of a similar nature within the last twelve months.

PART 2 PRODUCTS

2.01 AUDIOVISUAL RECORDING

A. The total audio-visual system and the procedures employed in its use shall produce a finished product that will fulfill the technical requirements of the project. The DVD portion of the recording shall produce bright, sharp, clear pictures with accurate colors and shall be free from distortion or any other form of picture imperfection. All DVD recordings shall by electronic means, display on the screen the time of day, the month, day and year of the recording. This time and date information must be continuously and simultaneously generated with the actual recording. The audio portion of the recording shall produce the commentary of the camera operator with proper clarity and be free of distortion.

B. Equipment

1. Camera: The color DVD camera used in the recording system shall be of Industrial Grade and shall provide DVD images and audio that complies with the performance requirements of this specification.

2. Recorder: The recording shall be made with an Industrial Grade DVD recorder.

3. DVD: DVD's shall be new and thus shall not have been used for any previous recordings. Two (2) complete sets of DVD's (one original and one copy) and logs will be provided upon acceptance of recordings.

4. DVD Playback Compatibility: The DVD's shall be compatible for playback with any American TV Standard DVD player.

C. Photographs

The DVD system shall have the capability to transfer individual frames of DVD electronically into hard copy prints or photographic negatives, as requested by the Engineer.

PART 3 EXECUTION

3.01 TECHNIQUE

A. Factual presentation.

B. Correct exposure and focus.

1. High resolution and sharpness.

2. Maximum depth-of-field.

3. Minimum distortion.

3.02 VIEWS REQUIRED

A. Photograph from locations to adequately illustrate the existing condition of the entire construction site and landfill closure area, including the landfill entrance and exit, all access roads proposed for use by the Contractor, designated staging and storage areas, etc., prior to initiating construction.

3.03 PAYMENT

A. The work specified in this Section shall be considered incidental and the cost shall be included as part of the unit prices for the project.

3.04 AUDIOVISUAL RECORDING

A. The recordings shall contain coverage of all surface features within the construction zone, including all access and exit routes. Features shall include, but not be limited to, all roadways, pavement, leachate pond, drainage ditches, sedimentation ponds, curbs, driveways, sidewalks, culverts, headwalls, retaining walls, landscaping, trees, and fences. Recording coverage shall be limited to one side of the walk through area at a time and shall include all surface conditions located within the construction zone supported by an appropriate audio description. Panning, zoom-in and zoom-out rates shall be sufficiently controlled to maintain a clear view of the project site.

B. The audio recording, containing the commentary of the camera operator, shall assist in viewer orientation and in any needed identification, differentiation, clarification, or objective description of the features being shown in the recording. The audio recording shall also be free from any outside conversation.

C. DVD Indexing

1. All DVD's shall be permanently labeled and shall be properly identified by DVD number, Owner's name, date of recording, location and project name and number.

2. DVD Log: Each DVD shall have a log of that recording. The log shall describe the various segments of coverage contained on that DVD in terms of the names of locations or easements, coverage beginning and end, directions of coverage, engineering stationing numbers when possible, and the date of the recording. DVD logs shall be supplied in three ring vinyl cover binders and labeled on the front and spine with project name, date and location.

D. Visibility: All recordings shall be performed during times of good visibility. No recording shall be done during periods of significant precipitation, mist or fog. The recording shall only be done when sufficient sunlight is present to properly illumination.

E. In order to ensure the continuity of coverage, the coverage shall consist of a single continuous unedited recording which begins at one end of a particular construction area; however, where coverage is required in areas not accessible by conventional transportation, such coverage shall be obtained by walking or by a special means of transportation approved by the Engineer.

F. The average rate of travel during a particular segment of coverage shall be directly proportional to the number, size, and value of the surface features within that construction area.

G. Camera Operation

1. Camera Height and Stability: When conventional wheeled vehicles are used during the recording, the vertical distance between the camera and the ground shall not exceed 10 feet. The camera shall be firmly mounted such that transport of the camera during the recording process will not cause an unsteady recording.

2. Camera Control: Camera pan, tilt, zoom-in and zoom-out rates shall be sufficiently controlled such that recorded objects can be clearly viewed. In addition, all other camera and recording system controls shall be properly controlled or adjusted to maximize picture quality.

END OF SECTION

SECTION 01410

TESTING AND LABORATORY SERVICES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Contractor shall employ and pay for the services of an independent Quality Control Laboratory (QCL) to perform the conformance testing, for soils and concrete, specifically indicated in the Contract Documents. The QCL shall be approved by the Owner and Engineer.

1. Contractor shall cooperate with the laboratory to facilitate the execution of its required services.

2. Employment of the laboratory shall in no way relieve Contractor's obligations for quality control to perform the Work of the Contract.

3. Contractor shall be responsible for all conformance testing.

B. Contractor shall employ and pay for the services of an independent GRI certified Quality Assurance Laboratory (QCL) to perform HDPE geomembrane, geotextile, and geocomposite drainage layer material conformance testing specifically indicated in the Contract Documents. The QCL shall be approved by the Owner and Engineer.

1. Employment of the laboratory shall in no way relieve Contractor's obligations for quality control to perform the Work of the Contract.

2. Contractor shall cooperate with the laboratory to facilitate the execution of its required services.

3. Contractor shall be responsible for all conformance testing.

C. Owner may elect to employ and pay for the services of a Quality Assurance Laboratory (QAL) to perform additional testing beyond the responsibilities of Contractor in order to confirm the quality of the Contractor's work and the conformance test results provided by the Quality Control Laboratory (QCL). If any test indicates the materials and equipment fail to meet the requirements of the Contract Documents, the Contractor shall incur the cost of all re-tests and all associated labor costs. The total of such costs shall be deducted from payment due the Contractor.

1.02 RELATED REQUIREMENTS

A. Conditions of the Contract: Inspections and testing required by laws, ordinances, rules, regulations, orders or approvals of public authorities.

B. Respective sections of specifications: Certification of products.

C. Each specification section listed: Laboratory tests required and standards for testing.

D. Testing Laboratory: inspection and sampling and testing is required for but not limited to the following:

1. Section 02200: Excavation, Backfill, and Compaction
2. Section 02274: Composite Drainage Net
3. Section 02276: Erosion and Sedimentation Control
4. Section 02776: High Density Polyethylene (HDPE) Liner.
5. Section 03300: Concrete and Reinforcing Steel

1.03 LIMITATIONS OF AUTHORITY OF QUALITY CONTROL LABORATORY

A. Laboratory is not authorized to:

1. Release, revoke, alter or enlarge on requirements of Contract Documents.
2. Approve or accept any portion of the Work.
3. Perform any duties of the Contractor.

1.04 CONTRACTOR'S RESPONSIBILITIES

A. Cooperate with laboratory personnel, provide access to work and to manufacturer's operations and provide copies of all test results to Engineer.

B. Secure and deliver (by hand or overnight delivery service) to the laboratory adequate quantities of representative samples of materials proposed to be used and which require testing.

C. Materials and equipment used in the performance of work under this Contract are subject to inspection and testing at the point of manufacture or fabrication. Standard specifications for quality and workmanship are indicated in the Contract Documents. The Engineer may require the Contractor to provide statements or certificates from the manufacturers and fabricators that the materials and equipment provided by them are manufactured or fabricated in full accordance with the standard specifications for quality and workmanship indicated in the Contract Documents. All costs of this testing and providing statements and certificates shall be a subsidiary obligation of the Contractor, and no extra charge to the Owner shall be allowed on account of such testing and certification.

D. Furnish incidental labor and facilities:

1. To provide access to work to be tested.
2. To obtain and handle samples at the Project site or at the source of the product to be tested and installed in the Contract work.
3. To facilitate inspections and tests.

4. For storage and handling of test samples.

E. Notify laboratory sufficiently in advance (48 HRS Min.) of operations to allow for laboratory assignment of personnel and scheduling of tests.

1. Contractor shall notify Engineer fourteen (14) days in advance of synthetic liner installation in order to schedule liner specialty inspector.

F. Employ and pay for the services of the same or a separate, equally qualified independent testing laboratory to perform additional inspections, sampling and testing required for the Contractor's convenience.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION

SECTION 01510

TEMPORARY UTILITIES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall furnish, install and maintain temporary utilities required for construction and remove on completion of work.

1.02 RELATED REQUIREMENTS

A. Section 01010: Summary of Work.

B. Section 01590: Field Offices.

1.03 REQUIREMENTS OF REGULATORY AGENCIES

A. Comply with National Electric Code.

B. Comply with Federal, State and local codes and regulations and with utility company requirements.

C. Comply with North Carolina Department of Transportation Regulations.

PART 2 PRODUCTS

2.01 MATERIALS, GENERAL

A. Materials may be new or used, but must be adequate in capacity for the required usage, must not create unsafe conditions, and must not violate requirements of applicable codes and standards.

2.02 TEMPORARY ELECTRICITY AND LIGHTING

A. Arrange with utility company, provide service required for power and lighting, and pay all costs for service and for power used in construction and testing.

B. Install circuit and branch wiring, with area distribution boxes located so that power and lighting is available as required for construction by the use of construction-type power cords.

2.03 TEMPORARY VENTILATION

A. Provide temporary ventilation as required to maintain adequate environmental conditions to facilitate progress of the Work to meet specified OSHA requirements.

B. Provide temporary ventilation, if necessary, to protect materials from damage due to temperature or humidity.

2.04 TEMPORARY TELEPHONE SERVICE

A. Arrange with local telephone Service Company. Provide direct line telephone service at the construction site for the use of Contractor's personnel, Engineer's personnel, and subcontractors as required.

B. Pay all costs for installation, maintenance and removal, as well as service charges for local calls and long distance.

2.05 TEMPORARY WATER

A. Provide and pay for all required water for construction and consumptive purposes in accordance with local standards and requirements.

2.06 TEMPORARY SANITARY FACILITIES

A. Provide sanitary facilities in compliance with laws and regulations.

B. Service, clean and maintain facilities and enclosures.

2.07 TEMPORARY PUMPS

A. Provide temporary pumps for removal of water from the excavation and fill areas when required by the Work to maintain proper conditions for construction.

PART 3 EXECUTION

3.01 GENERAL

A. Maintain and operate systems to assure continuous service.

B. Modify and extend systems as work progress requires.

3.02 REMOVAL

A. Completely remove temporary materials and equipment when their use is no longer required.

B. Clean and repair damage caused by temporary installations or use of temporary facilities.

C. Restore permanent facilities used for temporary services to specified condition.

END OF SECTION

SECTION 01590

FIELD OFFICE AND VEHICLE

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall furnish, install and maintain a temporary field office during the entire construction period and up to 30 days after final completion. A portion of the field office shall be made available to the Engineer when he is onsite and for bi-weekly progress meetings.

B. The Contractor shall furnish, install and maintain storage and covered work areas as needed for construction.

C. At completion of work, the Contractor shall remove field offices, temporary structures and contents.

D. The Contractor shall provide onsite transportation as needed by the Engineer.

1.02 OTHER REQUIREMENTS

A. Prior to installation of offices, consult with the Engineer and Owner on location, access and existing utilities.

1.03 SUBMITTALS

A. Submit to the Engineer for approval a layout of the Field Office and product data on the furnishings specified below.

1.04 REQUIREMENTS FOR FACILITIES

A. Construction:

1. Structurally sound, weathertight, with floors raised above ground.

2. Temperature transmission resistance: Compatible with occupancy and storage requirements.

3. At Contractor's option, portable or mobile buildings may be used.

   a. Mobile trailers, when used, shall be modified for office use.

   b. Do not use mobile trailers for living quarters.

B. Office Furniture and Services for the Engineer/Resident Project Representative:

1. Furnishings:

a. One standard size desk, 30-inch x 60-inch with upholstered chair, and three drawers, with locks and keys.

b. One drafting table: 39 inches (1 meter) x 72 inches (1.8 meters) x 36 inches (0.92 meter) high with one equipment drawer.

c. Two 4-drawer legal-size metal filing cabinets with lock, keys, and "Pendaflex" type hanging folder frames.

d. Six linear feet of bookshelves per desk (min. 4-ft high).

e. One drafting table stool, with back.

f. One wastebasket per desk and table.

g. One tackboard, 36 inches x 24 inches

h. Two fire extinguishers.

i. One industrial first aid kit, Mr. First Aid Kit No. 8029, or equal.

j. One minimum/maximum thermometer (Taylor or equal) and one rain gauge.

k. Xerox machine, Model XDL 33, with document feeder and sorter, and reduction and enlarging capability, complete with paper supplies for the duration of the Contract.

l. One 4-ft x 12-ft conference table, 12 chairs.

m. One bottled water dispenser with two taps, one hot and one cold, with accessory refrigerator.

5. Services:

a. Lighting: 50 foot-candles at desk top height.

b. Exterior lighting at entrance door.

c. Automatic heating and mechanical cooling equipment sufficient to maintain comfort conditions.

d. Minimum of ten 110-volt duplex electric convenience outlets, at least one on each wall.

e. Electric distribution panel: Six circuits minimum, 125-amp, 60-hertz service.

f. Speaker Phone Telephones (three (3) push-button type): one direct line with local and long distance access, one dedicated DSL line for internet access; one dedicated line for facsimile machine; and one answering machine to receive and record incoming calls.

g. Equip washroom with flush toilet, wash basin with two faucets, toilet tissue holder, 10-gallon capacity automatic electric water heater, and paper towel holder.

h. Provide potable water service to all trailer fixtures.

i. Provide a single water discharge to nearest approved sanitary facilities.

j. Provide fire insurance extended coverage and vandalism, malicious mischief, and burglary and theft insurance coverage for trailer contents furnished by the Engineer in the amount of $5,000. Provide proof of coverage.

k. Provide security system.

B. Contractor's Office and Facilities:

1. Size: As required for general use and to provide space for project meetings.

2. Lighting and temperature control: As specified for the Engineer's office.

3. Telephone: One direct line instrument.

4. Racks and files for Project Record Documents.

5. Other furnishings: Contractor's options.

6. One 10-inch outdoor-type thermometer with daily maximum and minimum observed temperature indicators.

7. One rain gauge.

8. Two (2) six-foot (6') conference tables, 14 folding chairs.

C. The Contractor shall make all provisions and pay all installations and other costs for the field office in order to provide water, sewer, telephone service (local and long distance and DSL for unlimited Internet access), power service, and exterior lights at the project site available for the Engineer's use. The Contractor shall pay all monthly charges for the various services provided to the Engineer's office throughout the construction period and for a minimum of 30 days after final completion.

1.05 USE OF PERMANENT FACILITIES

A. Permanent facilities shall not be used for field offices or for storage.

1.06 REQUIREMENTS FOR VEHICLES

A. The Contractor shall supply one (1) new or like-new four-wheel drive vehicle (less than 20,000 miles) for the Engineer's exclusive use on-site

B. The Contractor shall pay all charges associated with supplying and maintaining the vehicles including all fluids, fuel, filters, weekly cleanings, insurance, etc. for the duration of the project. During vehicle repairs, a comparable substitute shall be provided within 24 hours.

C. The vehicles shall remain the property of the Contractor upon final completion and Final Acceptance of the Project.

D. The Contractor shall retain ownership of the vehicles. The Contractor shall provide proof of insurance demonstrating compliance with the terms of this section and limits of liability in the Contract Documents and shall furnish registrations, license plates and proof of emissions inspections and do whatever is necessary to assure that the vehicle(s) is street legal and in compliance with all laws and regulations. All documentation is required prior to or concurrent with delivery of the vehicle(s) to the Engineer. The Contractor shall obtain and pay for all annual fees, inspections, tests, and paperwork necessary to keep the vehicle(s) street legal for the life of the contract, including but not limited to: registration renewals, new license plates, emissions testing, replacement of insurance cards, payment of taxes, etc. The Contractor shall perform whatever repairs are necessary to ensure that the vehicle(s) pass the required emissions tests.

E. The Engineer will assign operators for the vehicle(s). The Engineer will furnish to the Contractor a list of approved operators for the vehicle(s) along with a copy of the valid driver's license for each approved operator. The Contractor shall insure all operators assigned by the Engineer on his vehicle insurance policy with the same limits as specified in the Contract Documents for the Contractor's own staff. The Contractor shall be responsible to pay any deductible charged by his insurance company for any accident regardless of who is responsible. The Contractor shall not be responsible for moving violation citations received by vehicle operators.

PART 2 PRODUCTS

2.01 MATERIALS, EQUIPMENT, FURNISHINGS

A. May be new or like-new, but must be serviceable, adequate for required purpose, and must not violate applicable codes or regulations.

PART 3 EXECUTION

3.01 PREPARATION

A. Fill and grade sites for temporary structures to provide surface drainage.

B. Install and maintain a gravel parking area in front of Engineer's trailers for up to ten (10) vehicles.

3.02 INSTALLATION

A. Have office equipped and ready for use 15 days before work begins at the site.

B. Construct temporary field offices on proper foundations, provide connections for utility services.

1. Secure portable or mobile buildings when used.

2. Install stairs, 5' x 5' platform porch, and handrails and fixed boot brushes at each exterior door.

3. Provide hurricane tie-downs.

C. Mount thermometer and rain gauge at convenient outside locations. Thermometer should not be mounted in direct sunlight. Rain gauge should be mounted vertically and should be located sufficient distance (two times the height of the tallest structure or natural feature) from structures or other wind breaks. Keep the rain gauge free of debris and obstructions.

D. Locate construction office facilities at the location acceptable to the Engineer and Owner within the project area.

3.03 MAINTENANCE AND CLEANING

A. Furnish, replace and replenish light bulbs, fluorescent tubes, bottled water, cups, toilet paper, paper towels, soap and other things required to maintain the office.

B. Wash floor and clean washroom fixtures at least once each week. Wash windows when needed or when requested by Engineer. Sweep floor and dust furnishings daily.

C. Maintain office in first class condition for the duration of the project.

3.04 REMOVAL

A. Remove temporary field offices, contents and services at a time when no longer needed.

B. Remove foundations and debris; grade site to required elevations and clean the areas.

3.05 INSTALLATION AND MAINTENANCE COMMUNICATIONS EQUIPMENT

A. Installation of communications equipment in the field office shall be done in accordance with the Manufacturer's recommendations and instructions.

B. Furnish the services of a qualified service technician to supervise installation of communications equipment, and to check the operation of the equipment upon satisfactory installation.

C. Furnish a dedicated line for computer service.

END OF SECTION

SECTION 01600

MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Material and equipment incorporated into the Work:

1. Conform to applicable specifications and standards.

2. Comply with size, make, type and quality specified, or as specifically approved in writing by the Engineer.

3. Manufactured and Fabricated Products

   a. Design, fabricate and assemble in accord with the best Engineering and shop practices.
   b. Manufacture like parts of duplicate units to standard sizes and gauges, to be interchangeable.
   c. Two or more items of the same kind shall be identical, by the same manufacturer.
   d. Products shall be suitable for service conditions.
   e. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.

4. Do not use material or equipment for any purpose other than that for which it is designed or is specified.

1.02 RELATED REQUIREMENTS

A. Section 00700: General Conditions

B. Section 00800: Supplementary Conditions

C. Section 01010: Summary of Work

D. Section 01041: Project Coordination

E. Section 01300: Shop Drawings, Product Data, and Samples

F. Section 01630: Product Options and Substitutions

G. Section 01710: Cleaning

H. Section 01740: Warranties and Bonds

1.03 APPROVAL OF MATERIALS

A. Only new materials and equipment shall be incorporated in the work. All materials and equipment furnished by the Contractor shall be subject to the inspection and approval of the Engineer. No material shall be incorporated into the work without prior approval of the Engineer.

B. The Contractor shall submit data and samples sufficiently early to permit consideration and approval before materials are necessary for incorporation in the work. Any delay of approval resulting from the Contractor's failure to submit samples or data promptly shall not be used as a basis of claim against the Owner or the Engineer.

C. In order to demonstrate the proficiency of workmen or to facilitate the choice among several textures, types, finishes, and surfaces, the Contractor shall provide such samples of workmanship or finish as may be required.

D. The materials and equipment used on the work shall correspond to the approved samples or other data.

1.04 MANUFACTURER'S INSTRUCTIONS FOR INSTALLATION

A. When Contract Documents require that installation of work shall comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to parties involved in the installation, including five copies to the Engineer.

1. Maintain one set of complete instructions at the job site during installation and until completion.

B. Handle, install, connect, clean, condition and adjust products in strict accord with such instructions and in conformity with specified requirements.

1. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Engineer for further instructions.

2. Do not proceed with work without clear instructions.

C. Perform work in accordance with manufacturer's instructions. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by Contract Documents.

1.05 TRANSPORTATION AND HANDLING

A. Arrange deliveries of Products in accord with construction schedules, coordinate to avoid conflict with work and conditions at the site.

1. Deliver Products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.

2. Immediately on delivery, inspect shipments to assure compliance with requirements of Contract Documents and approved submittals, and that Products are properly protected and undamaged.

B. Provide equipment and personnel to handle Products by methods to prevent soiling or damage to Products or packaging.

1.06 STORAGE AND PROTECTION

A. The Contractor shall furnish a covered, weather-protected storage structure providing a clean, dry, noncorrosive environment for all mechanical equipment, valves, and special equipment and materials to be incorporated into this project. Storage of materials shall be in strict accordance with the "instructions for storage" of each supplier and manufacturer. The Contractor shall furnish a copy of the manufacturer's instructions for storage to the Engineer prior to storage of all equipment and materials. Corroded, damaged or deteriorated equipment and parts shall be replaced before acceptance of the project. Equipment and materials not properly stored will not be included in a payment estimate.

B. Store Products in accordance with manufacturer's instructions, with seals and labels intact and legible.

1. Store products subject to damage by the elements in weathertight enclosures.

2. Maintain temperature and humidity within the ranges required by manufacturer's instructions.

3. Store fabricated products above the ground, on blocking or skids, to prevent soiling or staining. Cover products which are subject to deterioration with impervious sheet coverings, provide adequate ventilation to avoid condensation.

4. Store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign matter.

C. All materials and equipment to be incorporated in the work shall be handled and stored by the Contractor before, during, and after shipment in a manner to prevent warping, twisting, bending, breaking, chipping, rusting, and any injury, theft or damage of any kind whatsoever to the material or equipment.

D. Cement, sand and lime shall be stored under a roof and off the ground and shall be kept completely dry at all times. Brick, block and similar masonry products shall be handled and stored in a manner to reduce breakage, chipping, cracking, and spalling to a minimum.

E. All materials which, in the opinion of the Engineer, have become so damaged as to be unfit for the use intended or specified shall be promptly removed from the site of the work, and the Contractor shall receive no compensation for the damaged material or its removal.

F. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored Products to assure that Products are maintained under specified conditions, and free from damage or deterioration.

G. Protection After Installation

1. Provide substantial coverings as necessary to protect installed products from damage from traffic and subsequent construction operations. Remove covering when no longer needed.

H. The Contractor shall be responsible for all material, equipment, and supplies sold and delivered to the Owner under this Contract until final inspection of the work and acceptance thereof by the Owner. In the event any such material, equipment, and supplies are lost, stolen, damaged, or destroyed prior to final inspection and acceptance, the Contractor shall replace same without additional cost to the Owner.

I. Should the Contractor fail to take proper action on storage and handling of equipment supplied under this Contract within seven days after written notice to do so has been given, the Owner retains the right to correct all deficiencies noted in previously transmitted written notice and deduct the cost associated with these corrections from any amounts due and payable to the Contractor. These costs may be comprised of expenditures for labor, equipment usage, administrative, clerical, Engineering and any other costs associated with making the necessary corrections.

1.07 SPECIAL TOOLS

A. Manufacturers of equipment and machinery shall furnish any special tools required for normal adjustment, operations and maintenance, together with instructions for their use. The Contractor shall preserve and deliver to the Owner these tools and instructions in good order upon receipt but no later than ten (10) days prior to equipment start-up.

1.08 STORAGE AND HANDLING OF EQUIPMENT ON SITE

A. Because of the long period allowed for construction, special attention shall be given to the storage and handling of equipment on site. As a minimum, the procedure outlined below shall be followed.

1. Equipment shall not be shipped until approved by the Engineer. The intent of this requirement is to reduce on-site storage time prior to installation and/or operation. Under no circumstances shall equipment be delivered to the site more than one month prior to installation without written authorization from the Engineer. Operation and Maintenance Data as described in Section 01730 shall be submitted to the Engineer for review prior to shipment of equipment.

2. All equipment having moving parts such as gears, electric motors, etc. and/or instruments shall be stored in a temperature and humidity controlled building approved by the Engineer, until such time as the equipment is to be installed.

3. All equipment shall be stored fully lubricated with oil, grease, etc. unless otherwise instructed by the manufacturer.

4. A copy of the manufacturer's storage instructions shall be given to the Engineer and shall be carefully studied by the Contractor and reviewed with the Engineer by him. These instructions shall be carefully followed and a written record of this kept by the Contractor.

5. Moving parts shall be rotated a minimum of once weekly to insure proper lubrication and to avoid metal-to-metal "welding". Upon installation of the equipment, the Contractor shall

start the equipment, at least half load, once weekly for an adequate period of time to insure that the equipment does not deteriorate from lack of use.

6. Lubricants shall be changed upon completion of installation and as frequently as required thereafter during the period between installation and acceptance. Mechanical equipment to be used in the work, if stored for longer than ninety (90) days, shall have the bearings cleaned, flushed and lubricated prior to testing and startup, at no extra cost to the Owner.

7. Prior to acceptance of the equipment, the Contractor shall have the manufacturer inspect the equipment and certify that its condition has not been detrimentally affected by the long storage period. Such certifications by the manufacturer shall be deemed to mean that the equipment is judged by the manufacturer to be in a condition equal to that of equipment that has been shipped, installed, tested and accepted in a minimum time period. As such, the manufacturer will guarantee the equipment equally in both instances. If such a certification is not given, the equipment shall be judged to be defective. It shall be removed and replaced at the Contractor's expense.

1.09 WARRANTY

A. For all major pieces of equipment, submit a warranty from the equipment manufacturer as specified in Section 01740.

1.10 SPARE PARTS

A. The Contractor shall collect and store all spare parts as required by the manufacturer in accordance with paragraph 1.08 of this Section. In addition, the Contractor shall furnish to the Engineer an inventory listing all spare parts, the equipment they are associated with, the name and address of the supplier, and the delivered cost of each item. Copies of actual invoices for each item shall be furnished with the inventory to substantiate the delivered cost. The Contractor shall deliver the spare parts to the Owner not more than thirty (30) nor less than ten (10) days prior to leachate pretreatment system and pump station start-up.

B. All spare parts shall be the products of the original equipment manufacturer.

1.11 GREASE, OIL, AND FUEL

A. All grease, oil, and fuel required for testing of equipment shall be furnished with the respective equipment. The Owner shall be furnished with a year's supply of required lubricants including grease and oil of the type recommended by the manufacturer, and approved by the Owner, with each item of equipment supplied under Divisions 11, 12, 13, 14, 15 and 16. Refer to paragraph 2.01 for additional requirements for lubricants.

B. The Contractor shall be responsible for furnishing and changing the oil in all drives and intermediate drives of each piece of mechanical equipment after initial break-in of the equipment, which in no event shall be any longer than three weeks of operation.

PART 2 PRODUCTS

2.01 LUBRICANTS

A. All lubricants furnished on this Project shall be 100 percent paraffin based lubricants, which contain Monolec or Amosol, such as the products offered by Lubrication Engineers, Inc. (LE), Fort Worth, TX. Only LE lubricants, or approved equal paraffin based lubricants shall be used for factory testing of equipment. In the event that other lubricants are used for factory testing or furnished with the delivered equipment, the Contractor shall be responsible for draining, flushing and replacing the unapproved lubricants with acceptable products. Shop drawings shall indicate the manufacturer's recommended LE products, or proposed equal.

PART 3 EXECUTION (Not Used)

END OF SECTION

SECTION 01630

PRODUCT OPTIONS AND SUBSTITUTIONS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Furnish and install Products specified, under options and conditions for substitutions stated in this Section.

B. Whenever a product, material or item of equipment is specified or described by using the name of a proprietary product or the name of a particular manufacturer or vendor, followed by the phrase "or equal," the specific item mentioned shall be the basis upon which bids are to be prepared, and shall be understood as establishing the type, function, dimension, appearance and quality desired. Other manufacturer's or vendor's products not named will be considered as substitutions, provided the required information is submitted in the manner set forth in this section and provided the substitution will not require substantial revision to the Contract Documents.

1.02 RELATED REQUIREMENTS

A. Section 00100: Instruction to Bidders.

B. Section 00300: Bid Form.

C. Section 00700: General Conditions.

D. Section 00800: Supplementary General Conditions.

E. Section 01036: Change Order Procedures.

F. Section 01600: Material and Equipment.

1.03 CONTRACTOR'S OPTIONS

A. For products specified by naming several products or manufacturers, select any one of products and manufacturers named which complies with Specifications.

B. For products specified by naming one or more products or manufacturers and stating "or equal," submit a request as for substitutions, for any product or manufacturer which is not specifically named.

C. For products specified by naming only one product and manufacturer, there is no option and no substitution will be allowed.

1.04 SUBSTITUTIONS

A. In order for substitutions to be considered, the Contractor shall submit, within 30 days of issuance of Notice of Award, complete data as set forth herein to permit complete analysis of all proposed substitutions noted on his/her substitutions list. No substitution shall be considered unless the Contractor provides the required data in accordance with the requirements of this Section within the 30 day period.

B. Submit separate request for each substitution. Support each request with:

1. Complete data substantiating compliance of proposed substitution with requirements stated in Contract Documents:

   a. Product identification, including manufacturer's name and address.
   b. Manufacturer's literature; identify:
      1) Product description.
      2) Reference standards.
      3) Performance and test data.
      4) Operation and maintenance data.
   c. Samples, as applicable.
   d. Name and address and contact with phone number of similar projects on which product has been used and date of each installation.

2. Itemized comparison of the proposed substitution with product specified; list significant variations. Substitution shall not change design intent and shall perform equal to that specified.

3. Data relating to impact on construction schedule occasioned by the proposed substitution.

4. Any effect of substitution on separate contracts.

5. List of changes required in other work or products.

6. Accurate cost data comparing proposed substitution with product specified.
   a. Amount of any net change to Contract Sum.

7. Designation of required license fees or royalties.

8. Designation of availability of maintenance services, sources of replacement materials.

C. Substitutions will not be considered for acceptance when:

1. They are indicated or implied on shop drawings or product data submittals without a formal request from Contractor.

2. They are requested directly by a subcontractor or supplier.

3. Acceptance will require substantial revision of Contract Documents.

D. The Engineer's decision regarding evaluation of substitutions shall be considered final and binding. Requests for time extensions and additional costs based on submission of, acceptance of, or rejection of substitutions will not be allowed. All approved substitutions will be incorporated into the Agreement by Change Order.

1.05 CONTRACTOR'S REPRESENTATION

A. In making formal request for substitution, Contractor represents that:

1. He has investigated proposed product and has determined that it is equal to or superior in all respects to that specified.

2. He will provide same warranties or bonds for substitution as for product specified.

3. He will coordinate installation of accepted substitution into the Work and will make such changes as may be required for the Work to be complete in all respects.

4. He waives claims for additional costs caused by substitution which may subsequently become apparent.

5. Cost data is complete and includes related costs under his/her Contract, but not:

a. Costs under separate contracts.

b. Engineer's costs for redesign or revision of Contract Documents.

1.06 ENGINEER DUTIES

A. Review Contractor's requests for substitutions with reasonable promptness.

B. Notify Contractor, in writing, of decision to accept or reject requested substitution.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01700

CONTRACT CLOSEOUT

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Comply with requirements stated in Conditions of the Contract and in Specifications for administrative procedures in closing out the Work.

1.02 RELATED REQUIREMENTS

A. Section 00700: General Conditions.

B. Section 00800: Supplementary Conditions.

C. Section 01027: Application for Payment.

D. Section 01710: Cleaning.

E. Section 01720: Project Record Documents.

F. Section 01740: Warranties and Bonds.

G. The respective sections of Specifications: Closeout Submittals Required of Trades, Vendors, Suppliers, and Manufacturers.

1.03 PRELIMINARY SUBMISSIONS

A. Operating and Maintenance Submission at 85% billing.

1. Submit the following for approval prior to submitting an application for payment that shows the work 85% complete and prior to requesting a final review for certification of Substantial Completion:

    a. Bind operation and maintenance manuals, mechanical, electrical and plumbing operation diagrams and specific warranties in triplicate.
    b. Bind all documents in heavy-duty 3 ring binders.
    c. Type identifying labels behind clear plastic on edge of binder.
    d. Organize contents with marked laminated, reinforced index tabs in 16 Division format.
    e. Include typed table of contents.

B. Shop Drawings for Owner

1. Submit, also at 85% billing, a complete set of legible Contractor's approved, Engineer reviewed, shop drawings folded up in reinforced cardboard file storage boxes. Organize using expandable file folder pouches. Index pouch tabs with each specification section's

submission numerically, beginning with Division 1. Include typed listing of all Shop Drawings in transmittal boxes.

1.04 SUBSTANTIAL COMPLETION

A. When Contractor considers the Work substantially complete, he shall submit to the Engineer:

1. A written notice that the Work or designated portion thereof, is substantially complete including all required surveys and record drawings.

2. A list of items to be completed or corrected.

B. Within a reasonable time after receipt of such notice, the Engineer will make an inspection to determine the status of completion.

C. Should the Engineer determine that the Work is not substantially complete:

1. The Engineer will promptly notify the Contractor in writing, giving the reasons therefor.

2. Contractor shall remedy the deficiencies in the Work, and send a second written notice of substantial completion to the Engineer.

3. The Engineer will reinspect the Work.

D. When the Engineer finds that the Work is substantially complete, he will:

1. Prepare and deliver to Owner a tentative Certificate of Substantial Completion on EJCDC Form 1910-8-D, with a tentative list of items to be completed or corrected before final payment.

2. After consideration of any objections made by the Owner as provided in the Conditions of the Contract, and when the Engineer considers the Work substantially complete, he will execute and deliver to the Owner and the Contractor a definite Certificate of Substantial Completion with a revised tentative list of items to be completed or corrected.

1.05 FINAL INSPECTION

A. When Contractor considers the Work is complete, he shall submit written certification that:

1. Contract Documents have been reviewed.

2. Work has been inspected for compliance with Contract Documents.

3. Work has been completed in accordance with Contract Documents.

4. Equipment and systems have been tested in the presence of the Owner's representative and are operational.

5. Work is completed and ready for final inspection.

B. The Engineer will make an inspection to verify the status of completion with reasonable promptness after receipt of such certification.

C. Should the Engineer consider that the Work is incomplete or defective:

1. The Engineer will promptly notify the Contractor in writing, listing the incomplete or defective work.

2. Contractor shall take immediate steps to remedy the stated deficiencies, and send a second written certification to the Engineer that the Work is complete.

3. The Engineer will reinspect the Work.

D. When the Engineer finds that the Work is acceptable under the Contract Documents, he shall request the Contractor to make closeout submittals.

1.06 REINSPECTION FEES

A. Should the Engineer perform reinspections due to failure of the Work to comply with the claims of status of completion made by the Contractor:

1. Owner will compensate the Engineer for such additional services.

2. Owner will deduct the amount of such compensation from the final payment to the Contractor.

1.07 CONTRACTOR'S CLOSEOUT SUBMITTALS TO ENGINEER

A. Evidence of compliance with requirements of governing authorities.

B. Project Record Documents: To requirements of Section 01720.

C. Warranties and Bonds: To requirements of Section 01740.

D. Tools, Spare Parts and Maintenance Materials: To requirements of Section 01730.

E. Evidence of Payment and Release of Liens: To requirements of General and Supplementary Conditions.

F. Submit final meter readings for utilities and similar data as of the date of Substantial Completion.

1.08 FINAL ADJUSTMENT OF ACCOUNTS

A. Submit a final statement of accounting to the Engineer.

B. Statement shall reflect all adjustments to the Contract Sum.

1. The original Contract Sum.

2. Additions and deductions resulting from:

   a. Previous Change Orders.
   b. Allowances.
   c. Unit Prices.
   d. Deductions for uncorrected Work.
   e. Deductions for liquidated damages.
   f. Deductions for reinspection payments.
   g. Other adjustments.
   h. Inspection Overtime.
   i. Excessive shop drawing review cost by Engineer.

3. Total Contract Sum, as adjusted.

4. Previous payments.

5. Sum remaining due.

C. Engineer will prepare a final Change Order, reflecting approved adjustments to the Contract Sum which were not previously made by Change Orders.

1.09 FINAL APPLICATION FOR PAYMENT

A. Contractor shall submit the final Application for Payment in accordance with procedures and requirements stated in the Conditions of the Contract.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.01 GENERAL

A. The Contractor shall furnish all necessary tools and labor required to allow Engineer and Owner to verify the status of completion.

END OF SECTION

SECTION 01710

CLEANING

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Execute cleaning, during progress of the Work, and at completion of the Work, as required by General Conditions.

1.02 RELATED REQUIREMENTS

A. Section 00700: General Conditions

B. Each Specification Section: Cleaning for specific Products or work.

1.03 DISPOSAL REQUIREMENTS

A. Conduct cleaning and disposal operations to comply with codes, ordinances, regulations and anti-pollution laws.

PART 2 PRODUCTS

2.01 MATERIALS

A. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.

B. Use only those cleaning materials and methods recommended by manufacturer of the surface material to be cleaned.

C. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 EXECUTION

3.01 DURING CONSTRUCTION

A. Execute periodic cleaning to keep the Work, the site and adjacent properties free from accumulations of waste materials, rubbish and windblown debris, resulting from construction operations.

B. Provide on-site containers for the collection of waste materials, debris and rubbish.

C. Remove waste materials, debris and rubbish from the site and periodically dispose of at legal disposal areas away from the site.

3.02 DUST CONTROL

A. Clean interior spaces prior to the start of finish painting and continue cleaning on an as-needed basis until painting is finished.

B. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly-coated surfaces.

3.03 FINAL CLEANING

A. Employ skilled workmen for final cleaning.

B. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels and other foreign materials from sight-exposed interior and exterior surfaces.

C. Remove temporary protection and facilities installed for protection of the Work during construction.

D. Wash and shine glazing and mirrors.

E. Polish glossy surfaces to a clear shine.

F. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds.

G. Prior to final completion, or Owner occupancy, Contractor shall conduct an inspection of sight-exposed interior and exterior surfaces and all work areas, to verify that the entire Work is clean.

END OF SECTION

SECTION 01720

PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Contractor shall maintain at the site for the Owner one record copy of:

1. Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other Modifications to the Contract.
5. Engineer's Field Orders or written instructions.
6. Approved Shop Drawings, Working Drawings and Samples.
7. Field Test records.
8. Detailed Progress Schedule.

1.02 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. Store documents and samples in Contractor's field office apart from documents used for construction.

1. Provide files and racks for storage of documents.
2. Provide locked cabinet or secure storage space for storage of samples.

B. File documents and samples in accordance with CSI format.

C. Maintain documents in a clean, dry, legible, condition and in good order. Do not use record documents for construction purposes.

D. Make documents and samples available at all times for inspection by the Engineer.

E. As a prerequisite for monthly progress payments, the Contractor is to exhibit and provide currently updated "Record Drawings" (two sets of blue prints) for review by the Engineer and Owner.

1.03 AUTOCAD UPDATE

A. Provide AutoCAD update by standards for Record Drawings which will be designated by the Engineer.

1.04 RECORDING

A. Label each document "PROJECT RECORD" or "RECORD DRAWING" as applicable, with month and year in large bold letters.

B. Record information concurrently with construction progress.

SECTION 01740

WARRANTIES AND BONDS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.

1.02 RELATED WORK

A. Section 00100: Instructions to Bidders.

B. Section 00700: General Conditions.

C. Section 00800: Supplementary General Conditions.

D. Section 01041: Project Coordination.

E. Section 01700: Contract Closeout.

F. Specific requirements for warranties for the Work and products and installations that are specified to be warranted are included in the individual Sections.

G. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

1.03 SUBMITTALS

A. Submit written warranties to the Owner prior to the date fixed by the Engineer for Substantial Completion. If the Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Owner.

B. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Owner within fifteen days of completion of that designated portion of the Work.

C. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner for approval prior to final execution.

D. Refer to individual Sections for specific content requirements, and particular requirements for submittal of special warranties.

E. Schedule of Special Warranties

1. Section 02274 - Composite Drainage Net

2. Section 02276 - Erosion and Sedimentation Control

3. Section 02624 - Corrugated High Density Polyethylene (HDPE) Drainage Pipe and Fittings

4. Section 02776 - High Density Polyethylene (HDPE) Liner.

5. Section 02985 - Seeding and Mulching

1.04 WARRANTY REQUIREMENT

A. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.

E. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the contract Documents.

F. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

G. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.05 FORM OF SUBMITTALS

A. Prepare in duplicate packets.

B. Format:
   1. Size 8.5-inches x 11-inches, punch sheets for standard three post binder.
      a. Fold larger sheets to fit into binders.

   2. Cover: Identify each packet with typed or printed title "WARRANTIES AND BONDS" List:
      a. Title of Project
      b. Name of Contractor.

C. Binders: Commercial quality, three post binder, with durable and cleanable plastic covers and maximum post width of two inches.

1.06 DEFINITIONS

A. Standard Product Warranties are pre-printed written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

B. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION

SECTION 02100

SITE PREPARATION

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, and equipment as needed to complete all work and perform all site preparation, complete as shown on the Drawings and as specified herein.

B. Obtain all permits as required for site work prior to proceeding with the work.

C. Contractor shall only work in areas that have erosion and sedimentation control measures installed and capable of handling sediment runoff. Work areas shall not be disturbed until all required erosion control measures are in place.

1.02 RELATED WORK

Related work includes, but is not limited to, the following:

A. Section 02200: Excavation, Backfill, and Compaction

B. Section 02276: Erosion and Sedimentation Control

C. Section 02985: Seeding and Mulching

1.03 SUBMITTALS

A. Submit copies of all permits required prior to any clearing and grubbing work.

B. Contractor shall submit a certified survey of the actual limits of clearing prepared by a Professional Land Surveyor in accordance with Section 01050.

C. Submit a schedule of values for all components of the erosion control measures to be installed.

PART 2: PRODUCTS (Not Used)

PART 3: EXECUTION

3.01 SURVEY

A. The Contractor shall stake out the limits of clearing for inspection by the Engineer and Owner.

B. The Contractor shall field verify locations of existing conditions (e.g. culvert piping, roadways, etc.) within the landfill expansion area and submit survey plan(s) indicating any discrepancies.

3.02 CLEARING

A. Cut and remove timber, trees, stumps, brush, shrubs, roots, grass, weeds, rubbish, and any other objectionable material resting on or protruding through the surface of the ground within the alternate borrow site location. Temporary stockpile of all cleared materials is to be verified by the Owner.

B. Trees, wetlands, and other vegetation designated on the Drawings or directed by the Engineer to remain shall be preserved and protected as specified.

3.03 GRUBBING, VEGETATION, TOPSOIL, AND UNSUITABLE SOIL REMOVAL

A. Grub and remove all stumps, roots in excess of 1-1/2 inches in diameter, matted roots, brush, timber, logs, concrete rubble, and all other debris encountered to a minimum of 18 inches below subgrade elevation, or as directed by Engineer.

B. Remove all topsoil and vegetation within the cut and fill sections of the limits of construction to a maximum of 12 inches, or as directed by the Engineer. Topsoil and vegetation shall not be stockpiled with common, select, or clay soil stockpiles.

C. All grubbing holes and depressions excavated below the original ground surface shall be backfilled with common fill and compacted to a density conforming to the surrounding ground surface.

3.04 DISPOSAL

A. Vegetation and unsuitable soil shall be stockpiled by the Contractor in the designated stockpile area shown on the plans or as directed by the Owner.

B. Chipping and grinding of cleared and grubbed material on-site will be performed by the Contractor in the designated stockpile area.

C. Any MSW waste excavated during the expansion shall be disposed at a MSW disposal facility approved by the Owner.

3.05 PROTECTION

A. Trees, wetlands, and other vegetation directed by the Engineer to remain shall be protected from damage by all construction operations by erecting suitable barriers, guards, and enclosures, or by other approved means. Clearing operations shall be conducted in a manner to prevent falling trees from damaging trees and vegetation designated to remain and to the work being constructed and so as to provide for the safety of employees and others.

B. Protection shall be maintained until all work in the vicinity of the work being protected has been completed.

C. Any damage to existing tree crowns, trunks, or root systems shall be repaired immediately. Roots exposed and/or damaged during the work shall immediately be cut off cleanly inside the exposed or damaged area. Cut surfaces shall be treated with an acceptable tree wound paint, and topsoil spread over the exposed root area.

D. When work is completed, all dead and downed trees shall be removed. Live trees shall be trimmed of all dead and diseased limbs and branches. All cuts shall be cleanly made at their juncture with the trunk or preceding branch without injury to the trunk or remaining branches. Cuts over 1-inch in diameter shall be treated with an acceptable tree wound paint.

E. Construction activities shall be restricted to those areas within the limits of construction designated on the Drawings, within public rights-of-way, and within easements provided by the Owner. Adjacent properties and improvements thereon, public or private, which become damaged by construction operations, shall be promptly restored to their original condition and to the full satisfaction of the property Owner.

END OF SECTION

SECTION 02200

EXCAVATION, BACKFILL, AND COMPACTION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and incidentals necessary to perform all excavation, backfill, compaction, and grading required to complete the work shown on the Drawings and specified herein. The work shall include, but not necessarily be limited to excavation, obtaining and hauling fill/backfill materials, filling/backfilling, grading, compaction, disposal of waste and surplus materials, placing crushed stone, constructing of berms, and all related work such as stable slope construction, sheeting, shoring, bracing, and dewatering.

B. All excavation, trenching, and related sheeting, bracing, etc. shall comply with the requirements of OSHA excavation safety standards 29 CFR Part 1926.650 Subpart P and State requirements. Where conflict between OSHA and State regulations exists, the more stringent requirements shall apply.

1.02 RELATED WORK

A. Section 01410: Testing and Laboratory Services.

B. Section 02100: Site Preparation.

C. Section 02276: Erosion and Sedimentation Control.

D. Section 02700: Drainage Materials.

E. Section 02985: Seeding and Mulching.

1.03 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM D422 – Standard Test Method for Particle-Size Analysis of Soils.

2. ASTM D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft^3 (600 kN-m/m^3)).

3. ASTM D854 – Standard Test Method for Specific Gravity of Soil Solids by Water Pycnometer.

4. ASTM D1140 – Standard Test Method for Amount of Material in Soils Finer Than No. 200 (75 micrometer) Sieve.

5. ASTM D1556 – Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.

6. ASTM D2216 – Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.

7. ASTM D2488 – Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).

8. ASTM D2937 – Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method.

9. ASTM D4318 – Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

10. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.04 SUBMITTALS

A. Furnish the Engineer a representative sample weighing approximately 50 pounds of each fill material, including sand and crushed stone, contained in sealed 5-gallon containers, at least 30 calendar days prior to the date of anticipated use of such material for approval, in accordance with Section 01410.

B. Submit quality control material conformance test results on soil materials as specified in Paragraph 2.02.

C. Excavation and excavation support designs shall be prepared by a licensed Professional Engineer, registered in the State of North Carolina, having a minimum of five years of professional experience in the design and construction of excavations and excavation support systems. Submit an original and three copies of the licensed Professional Engineer's certification, on the PE certification form attached to Section 01300, stating that the excavation support systems designs have been prepared by the Professional Engineer, are consistent with the proposed dewatering and drainage systems, and that the Professional Engineer will be responsible for their execution. Do not submit excavation support system designs unless requested in writing by the Engineer.

D. Dewatering and drainage system designs shall be prepared by a licensed Professional Engineer, registered in the State of North Carolina, having a minimum of five years of professional experience in the design and construction of dewatering and drainage systems. Submit an original and three copies of the licensed Professional Engineer's certification, on the PE certification form attached to Section 01300, stating that the dewatering and drainage system designs have been prepared by the Professional Engineer and that the Professional Engineer will be responsible for their execution. Do not submit dewatering and drainage system designs unless requested in writing by the Engineer.

1.05 QUALITY ASSURANCE/QUALITY CONTROL

A. The Contractor shall be responsible for Quality Control (QC).

1.06 PROTECTION

A. Sheeting and Bracing (if required)

1. Furnish, install, and maintain such sheeting and bracing as may be required by Federal, State, and local safety requirements to support the sides of excavations; to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction; and to protect adjacent improvements (structures, utilities, embankment, landfill, etc.) from undermining or other damage. If the Engineer is of the opinion that at any location sufficient or proper supports have not been provided, he/she may order additional supports put in, and compliance with such order shall not relieve or release the Contractor from his/her responsibility for the sufficiency of such supports. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and rammed. Where soil cannot be properly compacted to fill a void, lean concrete shall be used as backfill. All voids shall be filled to the satisfaction of the Engineer.

2. Construct the sheeting outside the neat lines of the foundation, unless indicated otherwise, to the extent deemed desirable for the method of operation. Sheeting shall be plumb and securely braced and tied in position. Sheeting and bracing shall be adequate to withstand all pressures to which the structure or trench will be subjected. Any movement or bulging which may occur shall be corrected to provide the necessary clearances and dimensions.

3. All sheeting and bracing shall be carefully removed in such manner as not to endanger the construction or other structures, utilities, or property. The Contractor's excavation support system designer shall provide direction for the abandonment of excavation support systems in such a manner that existing/proposed improvements are not damaged due to abandonment/removal activities. Such direction shall include cut-off elevations, elements to remain-in-place, removal procedures, etc. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand, which must be approved by the Engineer, by ramming with tools especially adapted to that purpose, or otherwise as may be directed.

4. The right of the Engineer to order sheeting and bracing left in place shall not be construed as creating any obligation on his/her part to issue such orders and his/her failure to exercise his/her right to do so shall not relieve the Contractor from liability for damages to persons or property occurring from or upon the work occasioned by negligence or otherwise, growing out of a failure on the part of the Contractor to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.

5. No sheeting is to be withdrawn if driven below mid-diameter of any pipe and under no circumstances shall any sheeting be cut off at a level lower than 1-ft above the top of any pipe.

B. Drainage and Dewatering

1. Dewatering shall be performed as specified during the excavation of organic matters and unstable soils from the site. Dewatering is expected to be required during the excavation and filling of ponds, ditches, and where the topsoil layer extends below the water table.

2. At all times during construction, provide and maintain proper equipment and facilities to remove all water entering excavations and keep such excavations dry so as to obtain a

satisfactory undisturbed subgrade condition until the fills, structures, or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water into the excavated areas. Groundwater shall be lowered to at least 2 feet below the bottom of excavations.

3. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation. Well or sump installations shall be constructed with proper sand filters to prevent drawing of finer grained soil from the surrounding ground.

4. Surface runoff shall be collected, drained to sumps, and pumped from the disposal unit to maintain an excavation bottom free from standing water.

5. Dewatering of wetlands or ditches filled with water shall be performed in such a manner as to control discharge water by use of sediment basins and/or check dams or other erosion control structures approved by the Land Quality Section of North Carolina Department of Environment and Natural Resources (NCDENR).

6. Take all additional precautions to prevent uplift of any structure during construction.

7. Drainage shall be disposed of so that flow or seepage back into the excavated area will be prevented. Drainage shall be disposed of in an approved area in accordance with regulatory requirements.

8. Flotation shall be prevented by maintaining a positive and continuous operation of the dewatering system. The Contractor shall be fully responsible and liable for all damages, which may result from failure of this system.

9. Remove the dewatering equipment after the system is no longer required.

10. Take all necessary precautions to preclude the accidental discharge of fuel, oil, etc in order to prevent adverse effects on groundwater or surface water quality.

C. Slope Stability

1. Some portions of the landfill expansion area are underlain by Municipal Solid Waste. The Contractor shall take all necessary precautions to avoid slope stability or bearing capacity failure due to fill placement, stockpiling construction materials, or any other construction activities.

2. The Contractor shall be solely responsible for the stability of all roadway embankments, unbalanced fills, stockpiles, and all other construction operations.

1.07 SOIL TESTING

A. Prior to the general placement of the fill and during such placement, the Engineer may select areas within the limits of the fill for testing by the QCL. The Contractor shall cooperate fully in obtaining the information desired.

B. Payment for testing by the QCL will be made by the Contractor. If test results are unsatisfactory, all costs involved in correcting deficiencies in compacted materials to the satisfaction of the Engineer, will be borne by the Contractor.

PART 2 PRODUCTS

2.01 MATERIALS

A. Materials for use as fill shall be as described below. The Contractor shall obtain the material from the borrow area designated on the Drawings.

B. Common fill shall consist of soil free of organic materials, loam, wood, trash, topsoil, highly micacious silt, debris, or other deleterious materials which will deteriorate in time or which cannot be properly compacted. Common fill shall not contain stones larger than three inches in diameter and shall have a minimum of 60 percent passing the No. 4 sieve, a maximum of 60 percent passing No. 200 Sieve, a maximum liquid limit of 50, and a maximum plasticity index of 15. Common fill shall not contain granite blocks, broken concrete, masonry rubble, or other similar materials. It shall have physical properties such that it can be readily spread and compacted during filling. Snow, ice, and frozen soil will not be permitted.

C. Select fill shall consist of soil free from organic materials, loam, wood, trash, topsoil, highly micacious silt, or other objectionable materials which may be compressible or which cannot be properly compacted. It shall contain no stones larger than two inches in diameter and shall have a maximum of 50 percent passing the number 200 sieve, a maximum liquid limit of 50 percent, and a maximum plasticity index of 15 percent.

D. Structural fill shall consist of a soil free of organic material, loam, wood, trash, topsoil, debris, frozen soil, or other deleterious material which may be compressible or which cannot be properly compacted. Gradation of the structural fill as determined by ASTM D422 shall be within the following limits:

Sieve	Percent Passing By Weight
1½-inch	100
No. 4	20 to 90
No. 40	5 to 75
No. 200	0 to 40

Structural fill should have a maximum liquid limit of 30 percent and maximum plasticity index of 10 percent.

E. Bridge lift fill shall be non-calcareous sand and gravel free from organic matter and other deleterious material. Gradation of the sand and gravel as determined by ASTM D422 shall be within the following limits:

Sieve	Percent Passing By Weight
6-inch	100
No. 4	30 to 80
No. 40	10 to 50
No. 200	0 to 10

G. Crushed Stone

1. All crushed stone shall be silica material that is sound, hard, durable, resistant to weathering, as defined by ASTM D2488 and free of overburden, spoil, shale, limestone, and organic material. The stone shall be free of deleterious materials such as flat, elongated, friable, decomposed, or micaceous pieces. Broken pieces of concrete, asphalt, or brick are not acceptable. Crushed stone shall be of the size and type shown on the Drawings.

I. Drainage Material

1. Refer to Section 02700 for the requirements of drainage materials.

2.02 CONFORMANCE TESTING

A. Periodic conformance testing shall be conducted by the Contractor's Quality Assurance Laboratory on common, select, and structural fill materials prior to their use on the project. The following tests shall be conducted at the indicated frequencies:

Test	Method	Frequency
Grain Size	ASTM D422	Every 4,000 cy or change in material
Atterberg Limits	ASTM D4318	Every 4,000 cy or change in material
Moisture/Density	ASTM D698	Every 4,000 cy or change in material
Natural Moisture	ASTM D2216	Every 4,000 cy or change in material

The grain size conformance tests and frequencies listed above also apply to bridge lift fill and crushed stone.

Results of the tests shall be submitted to the Engineer within 24 hours of test completion and prior to material use on the project. The Engineer reserves the right to reject material based on the results of these conformance tests and/or independent quality assurance testing conducted by the QAL. Rejected materials shall be removed from the site at no cost to the Owner.

PART 3 EXECUTION

3.01 GENERAL EXCAVATION

A. Excavation shall be made to the grades shown on the Drawings. The bottom of the excavations shall be rendered firm and dry and in all respects acceptable to the Engineer.

B. Excavation and dewatering shall be accomplished by methods which preserve the undisturbed state of subgrade soils. Soils which become soft, loose, "quick", or otherwise unsatisfactory for support of structures, earthen or man-made, as a result of inadequate excavation, dewatering,

proofrolling, or other construction methods shall be removed and replaced as required by the Engineer at the Contractor's expense.

C. Dewatering shall lower the groundwater to at least 2 feet below excavation subgrade and prevent "boiling" condition or detrimental underseepage at the base of the excavation as specified herein.

D. Excavation equipment shall be satisfactory for carrying out the work in accordance with the Specifications.

E. Proofroll exposed subgrades after stripping topsoil and organics with a minimum of two complete passes of a rubber tired heavy vehicle as approved by the Engineer. All proofrolling shall be conducted in the presence of the Engineer. Any areas that appear to be rutting, weaving, or otherwise unstable during proofrolling shall be overexcavated as directed by the Engineer and backfilled using bridge lift fill in accordance with Paragraph 3.04.F.

F. Topsoil, if any, and excess cut material will be stockpiled in locations approved by the Engineer.

3.02 TRENCH EXCAVATION

A. Excavation for all trenches required for the installation of pipes shall be made to the depths indicated on the Drawings and in such a manner and to such widths as will give suitable room for laying the pipe within the trenches, for bracing and supporting the trench sides, and for pumping and drainage facilities. Contractor shall render the bottom of the excavations firm and stable and in all respects acceptable to the Engineer.

B. The trench may be excavated by machinery to, or just above the designated subgrade provided that the material remaining in the bottom of the trench is not disturbed.

C. Where pipe is to be installed in fill, fill shall be placed and compacted to at least 2 feet above the top of the pipe (rough grade elevation) and then trenches re-excavated for pipe installation.

3.03 MISCELLANEOUS EXCAVATION

A. The Contractor shall perform all excavations necessary for the placing of seeding and plants, for constructing roadways, and any other miscellaneous earth excavation required under this Contract.

3.04 GENERAL BACKFILL

A. Materials placed in fill areas shall be placed to the lines and grades shown on the Drawings. Unless otherwise specified, common fill shall be used for backfill.

C. Material conforming to the requirements of common fill, select fill, structural fill, and bridge lift fill shall be placed in layers having a maximum thickness of 8 inches measured before compaction and shall be compacted as follows:

1. Common Fill: Shall be compacted to 95% of the standard Proctor (ASTM D698) maximum dry density, or as otherwise shown in the Drawings. Since these soils are moisture sensitive with respect to achieving proper compaction, particular care should be taken to control the moisture content during placement and compaction. The soils shall be wetted or dried as necessary so that the moisture content during compaction is within three percent of the optimum moisture content as determined by ASTM D698.Moisture

conditioning and compaction will likely be difficult during rainy or freezing weather due to the high fines content of the material.

2. Select Fill: Shall be compacted to 95% of the standard Proctor (ASTM D698) maximum dry density, or as otherwise shown in the Drawings. In areas beneath roadways, a 24-inch layer of select fill shall be compacted to 98% of the maximum dry density of ASTM D698. The soils shall be wetted or dried as necessary so that the moisture content during compaction is within two percent of the optimum moisture content as determined by ASTM D698.

3. Structural Fill: Shall be compacted to 98 percent of the maximum dry density as determined by ASTM D698. Structural fill should be placed at a moisture content at, or up to two percent below the optimum moisture content as determined by ASTM D698.

4. Bridge Lift Fill: In general, bridge lift fill shall be placed in one layer having a thickness equal to the depth of overexcavation required up to a maximum thickness of 24 inches. Bridge lift fill shall be proofrolled in accordance with Paragraph 3.01.E.

The minimum frequency of testing shall be 1 test per lift per 10,000 square feet or as directed by the Engineer in irregular-shaped fill areas.

D. Bridge lift fill shall be used where directed by the Engineer. Bridge lift fill material, as specified in Paragraph 2.01.E, shall be used to provide a stable base for placing common fill in areas where wet surface conditions interfere with the placement of fill material, and as suitable backfill material in undercut areas approved by the Engineer.

E. The surfaces of filled areas shall be graded to smooth true lines, conforming to grades indicated on the grading plan and no soft spots or uncompacted areas will be allowed in the work.

F. No compacting shall be done when the material is covered with frost or is frozen or is too wet either from rain or from excess application of water. At such times, work shall be suspended until the previously placed and new materials have thawed and/or dried sufficiently to permit proper compaction.

G. All backfill shall be placed at a moisture content within 2 percent of standard Proctor (ASTM D698) optimum moisture content, unless otherwise stated.

3.05 TRENCH BACKFILL

A. Backfilling over pipes shall begin as soon as practicable after the pipe has been laid, jointed, and inspected. All backfilling shall be performed expeditiously.

1. 78M stone shall be placed around the lower half of the pipe as shown on the Drawings and thoroughly rodded and tamped to fill all voids and provide uniform support of the pipe in the bedding zone. Select fill shall be thoroughly compacted by machine tamping in 8-inch-thick layers as required to provide 98% of the standard Proctor maximum dry density in accordance with ASTM D698.

2. Select fill shall be placed around the upper half of the pipe and to a minimum depth of 12 inches over the top of the pipe. Select fill shall be placed by hand-tamping in lifts not to exceed 4 inches

3. The remainder of the trench shall be backfilled with common fill in loose layers not to exceed 8 inches in thickness and thoroughly compacted with mechanical tampers as required to obtain the specified 95% compaction of the maximum dry density in accordance with ASTM D698.

4. Backfilling under haunches shall be performed manually by tamping rods or similar hand equipment to eliminate voids underneath sides of the pipe or haunch.

5. The minimum frequency for density tests shall be 1 test per lift per 50 linear feet of trench for all material types.

3.06 ROAD SUBGRADE

A. The road subgrade shall consist of a two-foot-thick layer of select fill. The select fill shall be placed and compacted in accordance with Paragraph 3.04.C.

B. The road subgrade areas in cut sections shall consist of firm natural soils as approved by the Engineer.

C. Road subgrades shall be proofrolled as described in Paragraph 3.01.E.

3.07 HANDLING OF SURPLUS MATERIAL

A. Excavated materials shall not be removed from the site except as specified by the Engineer. Materials shall be neatly stockpiled on-site at locations directed by the Owner. Excess materials shall be hauled and stockpiled. Contractor shall provide erosion and sedimentation control measures as shown on the Drawings and specified in Section 02276.

3.08 GRADING

A. Grading in preparation for placing clay liner, low-permeability material, or synthetic liner shall be performed to the elevations shown and otherwise as directed by the Engineer. The proposed grades shall be constructed to within 0.1 feet of the elevations indicated. All indicated slopes are minimum values. During the process of grading, the subgrade shall be maintained in such condition that it will be well drained at all times. When required, temporary drains and drainage ditches shall be installed to intercept or divert surface water which may affect the performance or condition of the work.

B. If at the time of grading it is not possible to place material in its final location, it shall be stockpiled in approved areas. Stockpiled material shall be placed, compacted, and smooth-rolled at the end of each day to deter water infiltration. No extra payment will be made for the stockpiling or double handling of excavated material.

C. Engineer reserves the right to make minor adjustments in lines or grades if deemed necessary as the work progresses, in order to obtain satisfactory construction.

D. Stones or rock fragments larger than 3 inches in their greatest dimensions will not be permitted in the top 6 inches of the finished subgrade of all fills or embankments.

END OF SECTION

SECTION 02270

RIPRAP

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and place riprap and appurtenances as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. Section 02200: Excavation, Backfill and Compaction.

B. Section 02272: Woven Fabric

PART 2 PRODUCTS

2.01 MATERIALS

A. Riprap used for check dams, slope protection, outfall and any other purpose shall be sound, durable rock angular in shape and of suitable quality to insure permanence in the condition in which it is to be used (see Drawings for specific NCDOT classification). Control of gradation shall be by visible inspection. Rounded stones, boulders, sandstone, or similar soft stone or relatively thin slabs will not be acceptable. Material shall be free from overburden, spoil, shale and organic materials, and meet the Engineer's approval.

B. A nonwoven geotextile shall be placed over the subgrade prior to placing the riprap. See Section 02272.

C. Riprap shall be placed and graded off in a manner to ensure that the larger rock fragments are uniformly distributed and that the smaller rock fragments serve to fill the spaces between the larger rock fragments in a manner that will result in a compact mass of stone of the specified thickness. Hand placing will be required only to the extent necessary to secure the results specified above.

D. Riprap shall have a minimum thickness as indicated on the Drawings with individual pieces at the surface having a maximum deviation of plus or minus 2-inch.

E. Placing of riprap in layers or by dumping into chutes or by similar methods to cause segregation will not be permitted.

PART 3 EXECUTION

3.01 WATER CONTROL

A. Prior to commencing work on riprap placement install water control measures as required to perform work in dry conditions. Water control measures shall include, but are not limited to, diversions, sheet pile, sumps with pumps, or other means necessary to maintain the level of groundwater below subgrade elevation and to divert surface water away from the work area.

3.02 INSTALLATION

A. The construction methods shall be in accordance with NCDOT Standard Specifications.

B. Riprap shall be placed to the limits and grades shown on the Drawings.

C. Channel slopes, bottoms, or other areas that are to be protected with riprap shall be free of brush, trees, stumps, and other objectionable material and be graded to a smooth compacted surface. The subgrade shall be dry and stable. If unsuitable materials are encountered they shall be removed and replaced in accordance with Section 02200 of the specifications. After an acceptable subgrade is established the geotextile shall be placed. Immediately following this the riprap shall be placed.

D. Following acceptable placement of the geotextile riprap placement shall commence as follows:

1. Machine Placed Riprap: Riprap shall be placed in a manner that will produce a reasonably well-graded mass of stone with the minimum practicable percentage of voids. Riprap shall be machine placed, unless otherwise stipulated in the Drawings or specifications.

    a. When riprap is placed on slopes, placement shall commence at the bottom of the slopes working up the slope. Place the riprap in a stepped fashion with the bottom of the uphill riprap below the top of the downhill riprap by half of the height of the riprap minimum.

    b. The entire mass of riprap shall be placed on either channel slopes or bottoms so as to be in conformance with the required gradation mixtures and to lines, grades, and thickness shown on the Drawings. Riprap shall be placed to its full course thickness at one operation and in such a manner as to avoid displacing the underlying material. Placing of riprap in layers, or by dumping into chutes, or by similar methods shall not be permitted.

    c. All material going into riprap protection for channel slopes or bottoms shall be so placed and distributed that there will be no large accumulations of either the larger or smaller sizes of stone. Some hand placement may be required to achieve this distribution.

    d. Contractor shall maintain the riprap protection until accepted. Any material displaced for any reason shall be replaced to the lines and grades shown on the Drawings at no additional cost to Owner. If the bedding materials are removed or disturbed, such material shall be replaced prior to replacing the displaced riprap.

2. Hand Placed Riprap: Hand placed riprap shall be required when the depth of riprap is less than two times the nominal stone size, or when required by the Drawings or specifications.

    a. Individual stones shall be hand placed to form a flat uniform surface and meet the specified depth of riprap, to the lines and grades as shown on the Drawings.

END OF SECTION

SECTION 02271

FABRIC CUSHION

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required to install fabric cushion complete as shown on the Drawings and as specified herein.

1.02 RELATED WORK

B. Section 02623: High Density Polyethylene (HDPE) Pipe.

A. Section 02700: Drainage Materials.

C. Section 02776: High Density Polyethylene (HDPE) Liner.

1.03 SUBMITTALS

A. Within 15 calendar days following the Notice to Proceed, submit the following information in accordance with Section 01300:

1. Manufacturer's background information.

2. Information on factory size, equipment, personnel, number of shifts per day and production capacity per shift.

3. List of typical material property values corresponding to the requirements of the specification and samples of the fabric cushion with attached certified test results.

4. Manufacturer's quality control program and manual including description of laboratory facilities.

5. A list of three projects where heavy weight geotextile fabric cushion was used, including:

a. Name and purpose of project, location and date of installation.

b. Name of owner, design engineer and installer.

c. Fabric mass per unit area and surface area.

d. Information on performance of the fabric cushion.

6. Shop Drawing, including details of overlap, seaming, anchoring, connections and other construction details.

B. Product labels shall clearly show the manufacturer or supplier name, style name and roll number.

C. Each shipping document shall include a notation certifying that the material is in accordance with the manufacturer's certificate.

D. Each geotextile roll shall be wrapped with a material that will protect the geotextile from damage due to shipment, water, sunlight and contaminants.

E. The protective wrapping shall be maintained during periods of shipment and storage. If the wrapping is damaged prior to installation, the outer wrap of geotextile material must be discarded before installation.

F. During storage, geotextile rolls shall be elevated off the ground and adequately covered to protect them from the following: site construction damage, extended exposure to ultraviolet (UV) radiation, precipitation, chemicals that are strong acids or strong bases, flames, sparks, temperature in excess of 71°C (160°F) and any other environmental condition that might damage the geotextile.

1.07 MATERIAL WARRANTY

A. The manufacturer shall warrant that the fabric cushion shall be of merchantable quantity (as defined by the Uniform Commercial Code). The manufacturer shall guarantee that the fabric cushion furnished is suitable for the purpose intended and free from defects of material and workmanship. In the event the fabric cushion fails to perform as specified, the fabric cushion manufacturer shall promptly replace defective fabric cushion without any cost to the Owner.

1.08 GUARANTEE

A. The Contractor shall guarantee the fabric cushion against defects in installation and workmanship for the period of two (2) years commencing with the date of Substantial Completion. The guarantee shall include the services of qualified service technicians and all materials required for the repairs at no expense to the Owner.

PART 2: PRODUCTS

2.01 GENERAL

A. The use of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration.

2.02 MATERIALS

A. Nonwoven Fabric

1. The fabric cushion shall be a nonwoven, needle punched fabric consisting of polypropylene or polyester fibers or filament formed into a stable network.

2. The fabric cushion shall be US 300NW by US fabrics or equal.

3. The fabric cushion shall be inspected by the manufacturer for broken needles by permanently installed on-line metal detectors at the production facility.

4. The fabric cushion shall be nonbiodegradable, nonreactive within a pH range of three to eleven, resistant to ultraviolet light exposure, and resistant to insects and rodents. The fabric cushion shall have achieved a minimum value of 97 percent for the EPA 9090 chemical resistance test. Test results from any sampled roll in the lot, when tested in accordance with ASTM D4759, shall meet or exceed the values listed in Table 1. All strength values are for the weaker principal direction.

TABLE 1

MINIMUM AVERAGE ROLL VALUES FOR FABRIC CUSHIONS

PROPERTIES	TEST METHOD	UNIT	MINIMUM AVERAGE ROLL VALUES
Mass per Unit Area	ASTM D5261	$oz./yd^2$	12
Puncture	ASTM D 4833	lbs	180

2.03 QUALITY CONTROL DOCUMENTATION

A. Prior to installation, the Contractor shall provide to the Owner the following information certified by the manufacturer for the delivered fabric.

1. Each roll delivered to the Project site shall have the following identification information:

- Manufacturer's name
- Product identification
- Gross roll weight
- Roll number
- Roll dimensions

2. Quality control certificates, signed by the manufacturer's quality assurance manager. Each certificate shall have a roll identification number, testing procedures, frequency and test results. At a minimum, the following test results shall be provided every 50,000 square feet of manufactured fabric in accordance with the test requirements specified in Paragraph 2.02.

- Puncture Strength

- Mass per Unit Area
- Mullen Burst Strength
- Grab Tensile
- Trapezoid Tear

2.04 CONFORMANCE TESTING

A. Conformance testing shall be performed by an independent testing laboratory procured by the Contractor. Engineer shall obtain samples from the delivered material, mark the machine direction and identification number. One sample shall be taken per 100,000 square feet, or one sample per lot, whichever results in the greater number of conformance tests. A Lot number will be defined as a continuous production process without changes to raw material or manufacturing methods. This sampling frequency may be increased as deemed necessary by the Engineer. For every change in Lot number, the Contractor shall performance conformance testing on the initial roll at the Contractor's expense. The samples shall be taken across the entire roll width and shall not include the first 3-ft. The following conformance tests shall be conducted at the laboratory.

1. Mass per unit area (ASTM D5261)
2. Puncture (ASTM D 4833)

B. These conformance tests shall be performed in accordance with test requirements Paragraph 2.02.

C. All conformance test results shall be reviewed by the Engineer and accepted, prior to the deployment of the fabric. All test results shall meet, or exceed, the property values listed in Paragraph 2.02.

D. Test specimens shall be obtained from each conformance sample in accordance with the respective ASTM standard. Average values shall be calculated from the test specimen results and compared to the minimum average roll values listed in Table 1. If any average value of a conformance sample is less than the minimum average value specified in Table 1, the sample shall be determined to be a failing sample. If a conformance sample fails, all rolls within the sampled 100,000 square feet or lot will be rejected for use on the project unless the Engineer approves additional testing.

E. The manufacturer reserves the right to obtain additional samples from rolls immediately before and after the failing roll or as directed by the Engineer and request testing by the Contractor at the manufacturer's expense. If these rolls pass, then only the failing roll will be rejected. If they fail, then the entire lot will be rejected.

F. If the fabric fails the initial material conformance tests, the Contractor shall pay for the cost of subsequent conformance testing until all conformance tests are passed and the fabric is accepted by the Engineer.

PART 3: EXECUTION

3.01 REQUIREMENTS PRIOR TO INSTALLATION

A. Preparation of the surface shall be in accordance with Section 02776.

B. The liner shall be cleaned of stones, soil, liner scrap, and all other materials, and a final inspection of the liner shall be performed by the Engineer.

C. The fabric cushion shall be inspected by the Engineer for imperfections and damage. All defective rolls shall be removed from the site at the expense of the contractor.

3.02 INSTALLATION

A. Fabric Cushion Placement

1. The fabric cushion shall be installed as shown on the Drawings and as specified herein.

2. The fabric cushion shall only be cut using a hook blade knife, scissors with rounded tips or as otherwise approved by the Engineer.

3. The Contractor shall exercise extreme care during installation to prevent damage to the HDPE liner. The Contractor shall prevent stones, soil, liner scrap, and all other material from being entrapped between the liner and the fabric cushion. Only smooth soled shoes approved by the Engineer shall be worn by the installers. The Contractor shall not use the installed fabric cushion as a storage area for tools and supplies.

4. The Engineer shall have the authority to order the immediate stoppage of work as a result of improper installation procedures or any reason that may cause defective installation.

5. Damage to the fabric cushion occurring during placement shall be repaired immediately at no additional expense to the Owner.

B. Seaming Method

1. Adjoining fabric cushion panels shall be overlapped a minimum of 4 inches and heat seamed using a hot-wedge welder. The heat seam shall be continuous along the length of the overlap. The area to be welded shall be clean and dry. The hot-wedge welding equipment shall be capable of continuously controlling and monitoring the temperature of the hot wedge platen.

2. All seams constructed on sloped surfaces that are 4 to 1 or greater shall be vertical seams. All vertical panels placed on 4 to 1 slopes or greater shall extend 5 feet beyond the toe of slope.

C. Cover

1. All fabric cushion shall be covered within fourteen days. If delay of rock layer installation exceeds 14 days a protective cover such as a woven geotextile with

SECTION 02272

WOVEN FABRIC

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required to install woven fabric complete as shown on the Drawings and as specified herein.

1.02 RELATED WORK

Related work includes, but is not limited to, the following:

A. Section 02200: Excavation, Backfill and Compaction.

B. Section 02230: Drainage Materials

C. Section 02276: Erosion and Sedimentation Control.

D. Section 02623: High Density Polyethylene (HDPE) Pipe.

1.03 REFERENCE STANDARDS

Reference standards include, but are not limited to, the following:

A. American Society for Testing and Materials (ASTM)

1. ASTM D3786 - Standard Test Method for Hydraulic Bursting Strength of Textile Fabrics - Diaphragm Bursting Strength Tester Method.

2. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.

3. ASTM D4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles.

4. ASTM D4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

5. ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile.

6. ASTM D4833 - Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products.

7. ASTM D4873 - Standard Guide for Identification, Storage and Handling of Geosynthetic Rolls and Samples.

8. ASTM D4355 - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus.

9. ASTM D5199 - Standard Test Method for Measuring the Nominal Thickness of Geosynthetics.

10. ASTM D5261 - Standard Test Methods for Mass per Unit Area (Weight) of Fabric

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.04 SUBMITTALS

A. Within 30 calendar days following the Notice to Proceed, submit the following information in accordance with Section 01300:

1. Manufacturer's background information.

2. Information on factory size, equipment, personnel, number of shifts per day and production capacity per shift.

3. List of material properties and samples of woven fabric with attached certified test results.

4. Manufacturer's quality control program and manual including description of laboratory facilities.

5. A list of ten completed facilities where the woven fabric is used including:

   a. Name and purpose of facility, its location and date of installation.

   b. Name of Owner, project manager, design Engineer and installer.

   c. Fabric thickness and surface area.

   d. Information on performance of the facility.

6. Shop Drawing, including details of overlap, seaming, anchoring, connections and other construction details.

7. Installation schedule.

8. A manual that specifically defines the quality control and quality assurance program during installation including manufacturer's installation instructions.

9. Copy of quality control certificates in conformance with Paragraph 2.02.

1.05 FABRIC APPLICATIONS

The woven fabric is to be used as a separator between sand and stone for the leachate collection system.

1.06 DELIVERY, STORAGE AND HANDLING

A. Woven fabric labeling, shipment and storage shall follow ASTM D4873.

B. Product labels shall clearly show the manufacturer or supplier name, style name and roll number.

C. Each shipping document shall include a notation certifying that the material is in accordance with the manufacturer's certificate.

D. Each woven fabric roll shall be wrapped with a material that will protect the geotextile from damage due to shipment, water, sunlight, and contaminants.

E. The protective wrapping shall be maintained during periods of shipment and storage. If the wrapping is damaged prior to installation, the outer wrap of woven fabric material must be discarded before installation.

F. During storage, woven fabric rolls shall be elevated off the ground (a minimum of 3-in) and adequately covered to protect them from the following: Site construction damage, extended exposure to ultraviolet (UV) radiation, precipitation, chemicals that are strong acids or strong bases, flames, sparks, temperature in excess of 71 deg C (160 deg F) and any other environmental condition that might damage the woven fabric.

1.07 MATERIAL WARRANTY

A The manufacturer shall warrant that the woven fabric shall be of merchantable quantity (as defined by the Uniform Commercial Code). The manufacturer shall guarantee that the woven fabric furnished is suitable for the purpose intended and free from defects of material and workmanship. In the event the woven fabric fails to perform as specified, the woven fabric manufacturer shall promptly replace defective woven fabric without any cost to the Owner.

1.08 GUARANTEE

A. The Contractor shall guarantee the woven fabric against defects in installation and workmanship for the period of two (2) years commencing with the date of Final Acceptance. The guarantee shall include the services of qualified service technicians and all materials required for the repairs at no expense to the Owner.

PART 2 PRODUCTS

2.01 GENERAL

A. The use of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration.

2.02 MATERIALS

A. Woven Monofilament Fabric

1. All fabric shall be a woven monofilament polypropylene fabric consisting of filaments formed into a stable network, such as Mirafi FW400 or equal.

2. The fabric shall be a woven monofilament material consisting of polypropylene formed into a stable network such that the filament retains their relative position to each other. The material shall be nonbiodegradable, nonreactive within a pH range of three to eleven, resistant to ultraviolet light exposure, and resistant to insects and rodents. Test results from any sampled roll in the lot, shall meet or exceed the values listed in Table 1. All strength values are in the weaker principal direction.

TABLE 1
MINIMUM AVERAGE ROLL VALUES
FOR WOVEN FABRICS

PROPERTIES	TEST METHOD	MINIMUM AVERAGE ROLL VALUES	
		UNIT	VALUE
Grab Tensile	ASTM D4632	lb	265
Grab Elongation	ASTM D4632	%	10
Puncture	ASTM D4833	lb	120
UV Resistance	ASTM D4355	%	70
Apparent Opening Size (AOS) Max	ASTM D4751	US Std. Sieve	40
Percent Open Area (POA)	CW-02215 Mod.	%	6
Permittivity	ASTM D4491	sec^{-1}	0.5
Water Flow Rate	ASTM D4491	gpm/ft^2	35

2.03 QUALITY CONTROL DOCUMENTATION

A. Prior to installation, the Contractor shall provide to the Owner the following information certified by the manufacturer for the delivered fabric.

1. Each roll delivered to the Project site shall have the following identification information:

   a. Manufacturer's name

   b. Product identification

   c. Roll number

   d. Roll dimensions

2. Quality control certificates, signed by the manufacturer's quality assurance manager. Each certificate shall have roll identification number, sampling procedures and test results for

every 50,000 square feet of manufactured fabric for the parameters specified in Paragraph 2.02.

2.04 CONFORMANCE TESTING

A. Conformance testing shall be performed by a GRI accredited independent testing laboratory employed by the Contractor and approved by the Owner. Engineer shall obtain samples from the delivered material, mark the machine direction and identification number. One sample shall be taken per 100,000 square feet, or one sample per lot, whichever results in the greater number of conformance tests. A lot number will be defined as a continuous production process without changes to raw material or manufacturing methods. This sampling frequency may be increased as deemed necessary by the Engineer. The samples shall be taken across the entire roll width and shall not include the first 3-ft. The following conformance tests shall be conducted at the laboratory:

2. Puncture resistance (ASTM D4833)

3. Grab tensile/elongation (ASTM D4632)

4. Permittivity (ASTM D4491)

5. Apparent opening size (ASTM D4751)

6. UV resistance (ASTM D4355)

B. These conformance tests shall be performed in accordance with test requirements Paragraph 2.02.

C. All conformance test results shall be reviewed by the Engineer and accepted, prior to the deployment of the fabric. All test results shall meet, or exceed, the property values listed in Paragraph 2.02.

D. Test specimens shall be obtained from each conformance sample in accordance with the respective ASTM standard. Average values shall be calculated from the test specimen results and compared to the minimum average roll values listed in Table 1. If any average value of a conformance sample is less than the minimum average value specified in Table 1, the sample shall be determined to be a failing sample. If a conformance sample fails, all rolls within the sampled 100,000 square feet or lot will be rejected for use on the project unless the Engineer approves additional testing.

E The manufacturer reserves the right to obtain additional samples from rolls immediately before and after the failing roll or as directed by the Engineer and request testing at the manufacturer's expense. If these rolls pass, then only the failing roll will be rejected. If they fail, then the entire lot will be rejected.

F. If the fabric fails the first-run unit conformance tests, the Contractor shall pay for the cost of subsequent conformance testing until all conformance tests are passed and the fabric is accepted by the Engineer.

PART 3 EXECUTION

3.01 INSTALLATION

A. Fabric Placement

1. The woven fabric shall be installed as shown on the Drawings and in accordance with the manufacturer's recommendations and approved shop drawings. The number of rolls and installed surface should be documented.

2. No mechanical equipment shall be allowed directly on top of the fabric.

3. Damage to the woven fabric occurring during placement shall be repaired immediately at no additional expense to the Owner.

B. Field Seaming

1. The woven fabric panels shall be sewn together. The thread used to sew the panels shall be compatible with landfill leachate and as approved by the manufacturer. Sewn woven fabric panels shall be overlapped by a minimum of 6-in.

3.02 FIELD QUALITY CONTROL

A. Prior to completion of the leachate collection system, the woven fabric installation and related work shall be inspected by the Engineer. All work in the system therein being inspected shall be complete, clean and ready for use. All work shall meet the requirements as to line, grade, cleanliness and workmanship, as determined by the Engineer.

B. All discrepancies shall be noted and repaired at no additional expense. Final acceptance of the system shall be contingent upon the approval of the Engineer.

3.03 DISPOSAL OF WASTE MATERIAL

A. Upon completion of installation, dispose of all trash, waste material and equipment used in connection with the performed work and shall leave the premises in a neat and acceptable condition.

END OF SECTION

SECTION 02273

NON-WOVEN FABRIC

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required to install filter fabric complete as shown on the Drawings and as specified herein.

1.02 RELATED WORK

Related work includes, but is not limited to, the following:

A. Section 02200: Excavation, Backfill and Compaction.

B. Section 02274: Composite Drainage Net

C. Section 02276: Erosion and Sedimentation Control

1.03 SUBMITTALS

A. Within 30 calendar days following the Effective Date of the Agreement, submit the following information in accordance with Section 01300:

1. Manufacturer's background information.

2. Information on factory size, equipment, personnel, number of shifts per day and production capacity per shift.

3. List of material properties and samples of filter fabric with attached certified test results.

4. Manufacturer's quality control program and manual including description of laboratory facilities.

5. A list of ten completed facilities where the filter fabric is used including:

    a. Name and purpose of facility, its location and date of installation.
    b. Name of owner, project manager, design engineer and installer.
    c. Fabric thickness and surface area.
    d. Information on performance of the facility.

6. Shop Drawing, including details of overlap, seaming, anchoring, connections and other construction details.

7. Installation Schedule

8. A manual that specifically defines the quality control and quality assurance program during installation including manufacturer's installation instructions.

9. Copy of quality control certificates in conformance with Paragraph 2.03.

1.04 REFERENCE STANDARDS

Reference standards include, but are not limited to, the following:

A. American Society for Testing and Materials (ASTM)

1. ASTM D5261 – Standard Test Method for Measuring Mass Per Unit Area of Geotextiles.

2. ASTM D4491 – Standard Test Methods for Water Permeability of Geotextiles by Permittivity.

3. ASTM D4533 – Standard Test Method for Trapezoid Tearing Strength of Geotextiles.

4. ASTM D4632 – Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

5. ASTM D4751 – Standard Test Method for Determining Apparent Opening Size of a Geotextile.

6. ASTM D4759 – Standard Practice for Determining the Specification Conformance of Geosynthetics.

7. ASTM D4833 – Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.

8. ASTM D4873 – Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples.

9. ASTM D6241 Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 FABRIC APPLICATIONS

The filter fabric is to be used beneath riprap installed as part of the sedimentation and erosion control measures, as a wrap around stone for the leachate collection pipes and any other purpose

shown on the Drawings. Filter fabric for the composite drainage net is addressed in Section 02774.

1.06 DELIVERY, STORAGE AND HANDLING

A. Geotextile labeling, shipment and storage shall follow ASTM D4873.

B. Product labels shall clearly show the manufacturer or supplier name, style name and roll number.

C. Each shipping document shall include a notation certifying that the material is in accordance with the manufacturer's certificate.

D. Each geotextile roll shall be wrapped with a material that will protect the geotextile from damage due to shipment, water, sunlight, and contaminants.

E. The protective wrapping shall be maintained during periods of shipment and storage. If the wrapping is damaged prior to installation, the outer wrap of geotextile material must be discarded before installation.

F. During storage, geotextile rolls shall be elevated off the ground and adequately covered to protect them from the following: Site construction damage, extended exposure to ultraviolet (UV) radiation, precipitation, chemicals that are strong acids or strong bases, flames, sparks, temperature in excess of 71 deg C (160 deg F) and any other environmental condition that might damage the geotextile.

1.07 MATERIAL WARRANTY

A. The manufacturer shall warrant that the filter fabric shall be of merchantable quality (as defined by the Uniform Commercial Code). The manufacturer shall guarantee that the filter fabric furnished is suitable for the purpose intended and free from defects of material and workmanship. In the event the filter fabric fails to perform as specified, the filter fabric manufacturer shall promptly replace defective filter fabric without any cost to the Owner.

1.08 GUARANTEE

A. The Contractor shall guarantee the filter fabric against defects in installation and workmanship for the period of two years commencing with the date of Final Acceptance. The guarantee shall include the services of qualified service technicians and all materials required for the repairs at no expense to the Owner.

PART 2 PRODUCTS

2.01 GENERAL

A. The use of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration.

2.02 MATERIALS

A. Nonwoven Fabric

1. All fabric shall be a nonwoven needle punched fabric consisting of polypropylene or polyester fibers formed into a stable network, such as Mirafi or equal.

2. Fabric with a unit weight of 6 oz/yd^2 shall be heat bonded to both sides of the drainage net.
3. Fabric with an 8 oz/yd2 unit weight shall be used for the fabric wrap of the leachate and gas collection systems and as an underlayment for riprap aprons, rock check dams, and sediment traps.

4. The fabric shall be nonbiodegradable and nonreactive within a pH range of 3 to 11, resistant to ultraviolet light exposure, and resistant to insects and rodents. The fabric shall have achieved a minimum value of 97 percent for the EPA 9090 chemical resistance test. Test results from any sampled roll in the lot, when tested in accordance with ASTM D4759, shall meet or exceed the values listed in Table 1.

TABLE 1
MINIMUM AVERAGE ROLL VALUES
FOR
GEOTEXTILE FABRICS

Properties	Test Method	Minimum Average Roll Values		
		Unit	6 oz.	8 oz.
Mass per Unit Area	ASTM D5261	oz./yd^2	6.0	8.0
Grab Strength	ASTM D4632	lbs	160	205
Grab Elongation	ASTM D4632	%	50	50
Puncture Resistance	ASTM D4833	lbs	95	110
Mullen Burst Strength	ASTM D3786	psi	300	350
Water Flow Rate	ASTM D4491	gpm/ft^2	100	95
Permittivity	ASTM D4491	sec^{-1}	1.4	1.05
Trapezoidal Tear	ASTM D4533	lbs	60	80
Equivalent Opening Size	ASTM D4751	mm	0.210	0.180

B. The manufacturer shall warrant the material against manufacturing defects and material degradation for a period of twenty years from the date of installation. The manufacturer shall replace any material which fails from the above causes within the warranty period. The manufacturer shall furnish a written warranty covering the requirements of this paragraph.

C. Geotextiles shall be inspected by the Engineer during deployment. All defective rolls shall be repaired or removed from the site at the expense of the contractor if the Engineer deems that repair is not possible.

D. Geotextiles shall only be cut using a hook blade knife, scissors with rounded tips or as otherwise approved by the Engineer.

E. The contractor shall exercise extreme care during installation of geotextiles to prevent damage to the HDPE liner. The contractor shall prevent rocks, soil, waste materials and other debris from being entrapped between the HDPE liner and geotextile. Only smooth soled shoes shall be worn by installers. The contractor shall not use installed geotextile as a storage area for tools and supplies.

F. The Engineer shall have the authority to order the immediate stoppage of work as a result of improper installation procedures or any reason that may result in a defective installation.

G. Fabric cushion panels shall be overlapped a minimum of 4 inches and heat seamed using a hot-wedge welder. The heat seam shall be continuous along the length of the overlap. The area to be welded shall be clean and dry. The hot-wedge welding equipment shall be capable of continuously controlling and monitoring the temperature of the hot wedge platen.

H. Fabric cushion seams constructed on sloped surfaces that are 4:1 or greater shall be vertical seams. All vertical panels placed on 4:1 slopes or greater shall extend 5 feet beyond the toe of slope.

I. All fabric cushion shall be covered within fourteen days. If delay of the protective cover installation exceeds 14 days a temporary protective cover such as a woven geotextile with high UV resistance shall be placed over the fabric cushion until the permanent protective cover material is placed.

J. Fabric repairs shall be made with patches of the same material, using an approved seaming system. The patch size shall be twenty-four inches larger in all directions than the area to be repaired. The corners of the patch shall be rounded. Stitches shall be located no closer than one inch from the edge of the patch.

K. The fabric used for the leachate collection system and riprap underlining shall be overlapped a minimum of 12 inches.

2.03 QUALITY CONTROL DOCUMENTATION

A. Prior to installation, the Contractor shall provide to the Owner the following information certified by the manufacturer for the delivered fabric.

1. Each roll delivered to the project site shall have the following identification information:

   a. Manufacturer's name

   b. Product identification

c. Gross roll weight

d. Roll number

e. Roll dimension

2. Quality control certificates, signed by the manufacturer's quality assurance manager. Each certificate shall have roll identification numbers, sampling procedures, frequency, and conformance test results. The following test results shall be provided in accordance with Table 1:

a. Thickness – every 90,000 ft^2

b. Trapezoidal Tear – every 90,000 ft^2

c. Puncture Resistance – every 90,000 ft^2

d. Mullen Burst Strength – every 90,000 ft^2

e. Grab Tensile – every 90,000 ft^2

f. UV Resistance – Once per formulation

g. Apparent Opening Size - every 540,000 ft^2

h. UV Resistance – Once per formulation

i. Water Flow Rate - every 540,000 ft^2

2.04 CONFORMANCE TESTING

B. Conformance testing shall be performed by the Quality Control Laboratory (QCL) selected and paid for by the Contractor. Samples shall be obtained from materials delivered to the site. Each sample shall be marked with machine direction and an identification number. One sample shall be taken per 100,000 square feet, or one sample per lot, whichever results in the greater number of conformance tests. This sampling frequency may be increased as deemed necessary by the Engineer. The samples shall be taken across the entire roll width and shall not include the first 3 feet. The following conformance tests shall be conducted at the laboratory:

1. Mass per unit area (ASTM D3776)
2. Mullen burst strength (ASTM D3786)
3. Puncture resistance (ASTM D4833) (filter fabric only)
4. Grab tensile (ASTM D4632)
5. Permittivity (ASTM D4491) (filter fabric only)
6. Apparent opening size (ASTM D4751) (filter fabric only)
7. Puncture resistance (GRI GM3)
8. Thickness (ASTM D5199)
9. Trapezoidal Tear (ASTM D4533)

C. All conformance test results shall be reviewed by the Engineer and accepted or rejected, prior to the deployment of the fabric. All test results shall meet, or exceed, the property values listed in Section 11.1 A.

D. Test specimens shall be obtained from each conformance sample in accordance with the respective ASTM or GRI standard. Average values shall be calculated from the test specimen results and compared to the minimum average roll values listed in Table 1. For the truncated cone puncture test the values of the test specimens will be directly compared to the values listed in Table 1. If any average value of a conformance sample is less than the minimum average value specified in Table 1 or, in the case of the truncated puncture cone test, if any value is less than the minimum value specified, the sample shall be determined to be a failing sample. If a conformance sample fails, all rolls within the sampled 100,000 sf or lot will be rejected for use on the project unless the Engineer approves additional testing.

E. If the Engineer approves additional testing, the manufacturer may obtain two additional samples from the failing roll and one sample each from the rolls manufactured immediately before and after the failing roll and have them tested at no additional expense to the Owner. If the additional testing passes, then all rolls will be accepted. If either of the samples from the failing roll fail, then that roll will be rejected. If either of the samples from the other rolls fail, then the all the rolls within the same 100,000 sf or lot will be rejected.

F. The cost of first-run conformance testing shall be borne by the contractor and shall be performed by an independent Quality Control Laboratory (QCL) selected by the contractor. If the fabric fails the first-run unit conformance tests, the contractor/manufacturer shall pay for subsequent conformance testing until all conformance tests are passed and the fabric is accepted by the Engineer.

PART 3 EXECUTION

3.01 REQUIREMENTS PRIOR TO INSTALLATION

A. Prior to the placement of the filter fabric, the subgrade shall be inspected and approved by the Engineer in accordance with Section 02200. The subgrade shall be smooth, uniform and compacted prior to installation of the fabric.

3.02 INSTALLATION

A. Fabric Placement

1. The filter fabric shall be installed as shown on the Drawings and in accordance with the manufacturer's recommendations and approved shop drawings.

2. The subgrade shall be maintained in a smooth, uniform and compacted condition during installation of the filter fabric beneath the riprap and NCDOT 467M stone.

3. Damage to the filter fabric occurring during placement shall be repaired immediately at no additional expense to the Owner.

4. All fabric installation for beneath erosion control stone shall be completely covered at the end of each work day unless otherwise approved by the Engineer.

B. Field Overlap

1. The fabric shall be overlapped a minimum of 12-inches.

3.03 FIELD QUALITY CONTROL

A. Two duplicate documentation files for fabric placement shall be maintained. One shall be maintained by the Contractor and the other by the Engineer. At the end of each work week the files shall be updated and checked to assure that all copies of pertinent project information are included in each file. The Contractor shall submit daily copies of the documentation to the Engineer.

B. The filter fabric installation and related work shall be inspected by the Engineer. All work in the system therein being inspected shall be complete, clean and ready for use. All work shall meet the requirements of cleanliness and workmanship, as determined by the Engineer.

C. Discrepancies shall be noted and repaired at no additional expense. Final acceptance of the system shall be contingent upon the approval of the Engineer.

END OF SECTION

SECTION 02274

COMPOSITE DRAINAGE NET

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment, and incidentals required and install high density polyethylene (HDPE) composite drainage net as shown on the Drawings and as specified herein.

1.02 RELATED WORK

Related work includes, but is not limited to the following:

A. Section 02100: Site Preparation.

B. Section 02200: Excavation, Backfill, and Compaction.

C. Section 02272: Filter Fabric.

D. Section 02776: High Density Polyethylene (HDPE) Liner.

E. Section 02700: Drainage Materials.

1.03 SUBMITTALS

A. Within 30 calendar days following the effective date of the Agreement, submit the following information:

1. Manufacturer's background information.

2. Information on factory size, equipment, personnel, number of shifts per day, and production capacity per shift.

3. List of material properties and samples of drainage net with attached certified test results.

4. Manufacturer's quality control program and manual including description of laboratory facilities.

5. A list of ten completed facilities where the composite drainage net is used including:

   a. Name and owner purpose of facility, its location, and date of installation.
   b. Name of, project manager, design engineer, and installer.
   c. Composite drainage net thickness and surface area.
   d. Information on performance of the facility.

8. ASTM D4716 – Standard Test Method for Determining the (In-plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of Geosynthetic Using a Constant Head.

9. ASTM D4751 – Standard Test Method for Determining Apparent Opening Size of a Geotextile.

10. ASTM D4833 – Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.

11. ASTM D4873 – Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples.

12. ASTM D5035 – Standard Test Method for Breaking Force and Elongation of Textile Fabrics.

13. ASTM D5199 – Standard Test Method for Measuring the Nominal Thickness of Geosynthetics.

14. ASTM D5261 – Standard Test Method for Measuring Mass per Unit Area of Geotextiles.

15. ASTM D5321 - Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method.

16. ASTM D7005 – Standard Test Method for Determining the Bond Strength (Ply Adhesion) of Geocomposites

B. Geosynthetic Research Institute (GRI)

1. GRI GS4- Time Dependent (Creep) Deformation Under Normal Pressure.

C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY CONTROL/QUALITY ASSURANCE

A. The Quality Control consists of conformance testing of the material delivered to the site and field quality control during installation. The Contractor will be responsible for Quality Control.

1. Conformance testing requirements are specified in Paragraphs 2.03 and 2.04. The purpose of conformance testing is to assure that the supplied material conforms to the Specifications and to the Manufacturer's quality control certificates.

2. Field quality control requirements are specified in Paragraph 3.03. The purpose of field quality control procedures is to assure that the composite drainage net material has been installed in accordance with the Specifications and Manufacturer's recommendations.

1.06 DELIVERY, STORAGE, AND HANDLING

A. The composite drainage net shall be shipped, stored, and handled in accordance with Manufacturer's recommendations and as specified herein.

B. No mechanical equipment shall be driven directly on top of the composite drainage net.

C. The composite drainage net shall be stored in such a way that it is protected from prolonged exposure to ultraviolet radiation and shall be elevated from the ground (a minimum of 3 inches) to protect the drainage net from standing water and intrusion of soil particles.

D. Rolls shall be stacked in pyramid configuration with a maximum of four rolls high.

E. The lowest rolls should be held off the ground by means of pallets or other similar methods.

F. Weeds should not be allowed to grow into the stored geonet.

1.07 PROJECT/SITE REQUIREMENTS

A. The underlying liner material shall be inspected and approved by the Engineer and any defects or damages shall be repaired by the Contractor prior to installation of the composite drainage nets.

1.08 MATERIAL WARRANTY

A. The manufacturer shall warrant that the drainage net shall be of merchantable quality (as defined by the Uniform Commercial Code). The manufacturer shall guarantee that the drainage net furnished is suitable for the purpose intended and free from defects of material and workmanship. In the event the drainage net fails to perform as specified, the Manufacturer shall promptly replace defective drainage net without any cost to the Owner.

1.09 GUARANTEE

A. The Contractor shall guarantee the composite drainage net against defects in installation and workmanship for the period of two years commencing with the date of Final Acceptance. The guarantee shall include the services of qualified service technicians and all materials and labor required for the repairs at no expense to the Owner.

PART 2 - PRODUCTS

2.01 GENERAL

A. The use of a Manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration.

2.02 MATERIALS

A. Geonet shall be a bi-planar or tri-planar product manufactured by extruding sets of high density polyethylene strands to form a three dimensional structure to provide planar water flow.

B. Composite drainage net shall be formed by heat bonding of a nonwoven geotextile to both sides of the geonet. The geonet must meet each of the property values listed. Heat bonding shall be performed by the Manufacturer prior to shipping to the site.

C. The primary composite drainage net shall be 250-mil FabriNet HF by GSE or equal.

D. The composite drainage net shall contain UV inhibitors to prevent ultraviolet light degradation.

E. The composite drainage net shall be manufactured from first quality, compounded resin.

F. Composite drainage net material shall meet the requirements listed in Table 1.

TABLE 1: PRIMARY COMPOSITE DRAINAGE NET

PROPERTIES	AVERAGE VALUES	TEST METHOD
COMPOSITE		
Transmissivity: Soil/geocomposite/liner gradient = 0.03 @ 1,000 psf 100 hour seat time	$1.0x10^{-3}$ m^2/sec (min)	ASTM D4716
Ply Adhesion	1.0 lb/in	ASTM D7005
GEONET		
Density	0.940 g/cc	ASTM D1505
Melt Index Condition 190/2.16	1.0 g/10 minutes (max)	ASTM D1238
Carbon Black Content	>2%	ASTM D4218
Nominal Thickness	250 mil	ASTM D5199
Tensile Strength (Machine Direction)	55 lbs/in	ASTM D5035
GEOTEXTILE		
Unit weight	6 oz/yd^2	ASTM D5261
Grab Tensile	160 lbs	ASTM D4632
Puncture Resistance	90 lbs	ASTM D4833
AOS	70 sieve	ASTM 4751
Permittivity	1.5 sec^{-1}	ASTM 4491

G. The geotextile shall be nonbiodegradable, nonreactive within a Ph range of three to eleven, resistant to ultraviolet light exposure, and resistant to insects and rodents. The geotextile shall be a nonwoven needle punched polypropylene fabric consisting of filaments formed into a stable network.

2.03 QUALITY CONTROL DOCUMENTATION

A. Prior to installation commencement of any composite drainage net material, the Contractor shall provide to the Owner the following information certified by the Manufacturer for the delivered drainage net.

1. Each roll delivered to the Project site shall have the following identification information:

- Manufacturer's name
- Product identification
- Thickness
- Roll number
- Roll dimensions

2. Quality control certificates, signed by the Manufacturer's quality assurance manager. Each certificate shall have roll identification number, sampling procedures, frequency and test results. At a minimum the following test results shall be provided at the frequencies listed below and at least once per lot in accordance with test requirements specified in Paragraph 2.02.E.

Test	Component	Frequency
Transmissivity	Geocomposite	200,000 ft^2
Peel Adhesion	Geocomposite	50,000 ft^2
Density	Resin/Geonet	Once per lot/50,000 ft^2
Melt Index	Resin	Once per lot
Carbon Black Content	Geonet	50,000 ft^2
Nominal Thickness	Geonet	50,000 ft^2
Tensile Strength	Geonet	50,000 ft^2
Unit Weight	Geotextile	100,000 ft^2
Grab Tensile	Geotextile	100,000 ft^2
Puncture Resistance	Geotextile	100,000 ft^2
AOS	Geotextile	500,000 ft^2
Permittivity	Geotextile	500,000 ft^2

2.04 CONFORMANCE TESTING

A. Conformance testing shall be performed by a GRI accredited independent Quality Control Laboratory (QCL) retained by the Contractor and approved by the Owner and Engineer. Contractor will obtain samples from the delivered material and mark the machine direction and identification number as directed by Owner's representative. Samples shall be taken at a rate of one per 100,000 square feet of installed material and at least once per lot whichever is greater. A lot shall be defined as a group of consecutively numbered rolls from the same manufacturing line. This sampling frequency may be increased as deemed necessary by the Owner. The samples shall be taken across the entire roll width and shall not include the first 3 feet. The following conformance tests shall be conducted at the laboratory:

1. Density (ASTM D1505), Geonet only
2. Carbon Black Content (ASTM D4218), Geonet only
3. Melt Index (ASTM D1238), Geonet only
4. Thickness (ASTM D5199), Geonet only
5. Transmissivity (ASTM D4716), Composite
6. Tensile Strength (ASTM D5035), Geonet only
7. Peel Adhesion (ASTM D7005), Composite

B. All conformance test results shall be reviewed by the Engineer and accepted or rejected, prior to the deployment of the composite drainage net. All test results shall meet, or exceed, the property values listed in Paragraph 2.02.E. In case of failing test results, the Contractor may request that other samples be tested by the QAL with the Manufacturer's technical representative present during the testing procedures. This retesting shall be paid for by the Contractor. The Manufacturer may obtain additional samples from rolls immediately before and after the failing roll or as directed by the Owner and have them tested by the QAL at his/her own expense. If these rolls pass, then only the failing roll will be rejected. If they fail, then the entire lot will be rejected.

C. Strength Testing Submittal

Submit results of direct shear testing for the geomembrane/composite drainage net and composite drainage net/protective cover soil interfaces in accordance with ASTM D5321 that verify acceptable interface shear strength. The actual materials to be used on the project shall be used in all tests. Each interface shear strength evaluation shall consist of at least 3 separate shear tests run at normal stresses (σ) of 1, 2, and 4 psi.

PART 3 - EXECUTION

3.01 PREPARATION

A. General

1. Preparation of the underlying liner material shall be in accordance Section 02776 of the Specifications.

2. The underlying liner material shall be inspected and approved by the Engineer prior to installation of the composite drainage net. All liner quality control activities must be completed and approved prior to the placement of composite drainage net.

3. A panel layout of the composite drainage net conforming to the panel layout for the liner installation under Section 02776 shall be presented to the Engineer and approved before the composite drainage net can be installed.

3.02 INSTALLATION

A. Panel Placement

1. Care shall be taken to keep the composite drainage net clean and free from debris prior to installation. If the composite drainage net is not clean, it should be washed prior to installation.

2. The composite drainage net shall be installed in such a manner as to ensure that it is not damaged in any way, and the following shall be complied with during installation:

   a. Composite drainage net shall be anchored as shown on the Drawings.

   b. On slopes, the composite drainage net shall be secured and rolled down the slope in such a manner as to continually keep the composite drainage net sheet in tension. If necessary, the composite drainage net shall be positioned by hand after being unrolled to minimize wrinkles.

   c. In the presence of wind, all composite drainage net shall be weighted with sandbags or by other means. Such sandbags shall be installed during placement and shall remain until replaced with cover material.

   d. Composite drainage net shall not be welded to geomembrane.

   e. Composite drainage net shall only be cut using cutting tools approved by the Manufacturer that will not damage the underlying geomembrane. Care shall be taken not to leave tools on the composite drainage net.

   f. Necessary precautions shall be taken to prevent damage to underlying layers during placement of the composite drainage net.

   g. During placement of composite drainage net, care shall be taken not to entrap in the composite drainage net dirt or excessive dust that could cause clogging of the drainage system and/or stones that could damage the adjacent geomembrane. If dirt or excessive dust is entrapped in the composite drainage net, it should be hosed clean prior to placement of the next material on top of it. In this regard, care shall be taken in handling the sandbags, to prevent rupture or damage of the sandbag. Contractor should cover composite drainage net within 3 days of installation to prevent dirt or rocks from washing/blowing into the composite drainage net.

B. Field Seams and Overlaps

1. The following requirements shall be met during installation of the composite drainage net:

   a. Adjacent rolls shall be overlapped by at least 4 inches or as recommended by Manufacturer. For end widths of panels, the composite drainage net shall be overlapped a minimum of 4 inches with the up slope panel placed over the down slope panel.

   b. Overlaps shall be secured by tying. Tying can be achieved by plastic fasteners or polymer braid approved by the Manufacturer. Tying devices shall be white or yellow for easy inspection. Metallic devices are not allowed.

   c. Tying shall be every 5 feet along the slope and every 6 inches along end-to-end seams unless otherwise recommended by Manufacturer.

   d. Horizontal seams on the slopes shall not be allowed unless it is demonstrated to the Engineer that it is absolutely necessary.

   e. In the corners of the side slopes where overlaps between perpendicular composite drainage net strips are required, an extra layer of composite drainage net, of at least one roll width, shall be unrolled along the slope, on top of the previously installed composite drainage net from top to bottom of the slope. In no case shall there be piercing of material to cover areas designated on the Drawings in less than full roll widths.

   f. The unbonded fabric on the topside of the drainage net shall be sewn or hot-wedge welded along seams of adjacent panels.

3.03 FIELD QUALITY CONTROL

A. Two duplicate documentation files for panel placement shall be maintained. One shall be maintained by the Contractor and the other by the Engineer. At the end of each work week the files shall be updated and checked to assure that all copies of pertinent project information are included in each file. The Contractor shall submit daily copies of the documentation to the Engineer.

B. Any holes or tears in the composite drainage net shall be repaired by placing a patch extending 1 foot beyond the edges of the hole or tear. The patch shall be secured to the original composite drainage net by placing ties every 6 inches. Tying devices shall be as specified in Paragraph 3.02.B. All repairs and patches shall be approved by the Engineer.

C. Damage to the composite drainage net occurring during the placement of the material overlying the composite drainage net shall be repaired immediately at no additional expense to the Owner.

D. Contractor shall ensure that all soil materials are placed in such a manner as to ensure:

1. The composite drainage net and underlying lining materials are not damaged.
2. Minimal slippage of the composite drainage net on underlying layers occurs.
3. No excess tensile stresses occur in the composite drainage net.

3.04 DISPOSAL OF WASTE MATERIAL

A. Upon completion of installation, the Contractor shall remove and dispose, in appropriate manner approved by the Owner, all trash, waste material, and equipment used in connection with the performed work and shall leave the premises in a neat and acceptable condition.

END OF SECTION

SECTION 02276

EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The work shown on the drawings and specified herein shall constitute the erosion control plan for this Project in conformance with the North Carolina Sedimentation Pollution Control Act and shall include repairing and maintaining existing erosion and sedimentation controls, constructing and maintaining proposed erosion and sedimentation controls and removing temporary erosion and sedimentation controls as necessary following stabilization of disturbed areas. The erosion control plans and details are based on the anticipated construction methods and sequences, and include the principal measures required by NCDENR Department of Land Quality. Other erosion control measures may be required to prevent sediment and erosion resulting from the actual means, methods and techniques employed during construction. Provide and pay for all required erosion and sedimentation control measures and comply with the erosion and sedimentation control plan approved by NCDENR for this project.

B. Temporary erosion controls may include, but are not limited to surface stabilization which shall be accomplished with erosion control matting, vegetation and mulch, temporary earthen diversion berms, temporary drainage pipes, sediment pond, level spreader, rip rap, silt fencing, sediment traps, rock check dams, riprap apron protection, inlet protection measures, dust control, and minimization of disturbed acreage. The Contractor will also be responsible for maintaining the existing sediment pond and all the perimeter channels throughout the project. The performance of the Contractor's erosion controls is subject to approval by the Owner and NCDENR Division of Land Quality.

C. The Contractor shall provide a temporary stormwater trash pump to remove stormwater in the cell area after each rain event. Inlet protection measure shall be installed as shown on the Drawings to reduce transport of sediments by the pumps. The pump is specified under Section 11314. The same pump shall be reinstalled at the low point of the stormwater segregation berm after installation of the stormwater segregation berm and tarp a shown on the Drawings. The Contractor will be responsible for operation and maintenance of the pump during the course of the project, including in the stormwater segregation area up until Final Completion.

D. Stockpiles shall be protected from transfer of material due to erosion by providing silt fencing along the toe of the slopes, using slope downdrains for long, steep slopes, and by maintaining stable slopes.

E. The Contractor is responsible for submitting and obtaining an amendment to the existing approved erosion and sedimentation control plan to cover any deviations from the approved plan, to include any additional disturbed areas to be included in the work. Contractor shall also provide a schedule of values for the various components of the sedimentation and erosion control measures shown on the Drawings.

1.02 APPLICABLE REGULATIONS

A. Comply with all applicable Federal, State and local laws and regulations concerning environmental pollution control and abatement. Any violations of laws and fines imposed shall be the sole responsibility of the Contractor including payment of fines.

1.03 NOTIFICATIONS

A. The Engineer will notify the Contractor in writing of any non-compliance with the foregoing provisions or of any environmentally objectional acts and corrective action to be taken. Failure of the Engineer to provide such notice shall not relieve the Contractor of his responsibility to comply with all applicable specification provisions, regulations and laws. State or local agencies responsible for verification of certain aspects of the environmental protection requirements may notify the Contractor in writing of any non-compliance with State or local requirements. The Contractor shall, after receipt of such notice from the Engineer or from the regulatory agency, immediately take corrective action. Such notice, when delivered to the Contractor or his authorized representative at the site of the work, shall be deemed sufficient for the purpose. If the Contractor fails or refuses to comply promptly, the Owner may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to any such stop orders shall be made the subject of a claim for extension of time or for excess costs or damages by the Contractor unless it is later determined that the Contractor was in compliance.

1.04 REFERENCE DOCUMENTS

Reference documents include, but are not limited to, the following:

A. Standard Building Code

B. North Carolina Sediment and Erosion Control Manual

C. NCDENR Approved Erosion Control Plan

1.05 RELATED WORK

Related work includes, but is not limited to, the following:

A. Section 02100: Site Preparation

B. Section 02200: Excavation, Backfill, and Compaction

C. Section 02985: Seeding and Mulching

1.06 SUBMITTALS

A. Submit to Engineer the following information:

1. Product data for all erosion and sedimentation control materials.

2. Manufacturer's installation recommendations for erosion control matting.

PART 2 PRODUCTS

2.01 GENERAL

A. The use of the manufacturer's name and product number is for the purpose of establishing the standard of quality and general characteristics desired.

2.02 CONTROL STRUCTURES

A. Provide erosion and sedimentation controls as shown on the Drawings and as specified herein. Controls may include, but not be limited to: seeding and mulching, riprap, erosion control stone, filter fabric, silt fence, earthen diversion berms, temporary drainage pipes, sediment basins, rock check dams, level spreaders, and other similar controls.

PART 3 EXECUTION

3.01 EROSION CONTROL

A. Minimum procedures for grassing are:

1. Scarify slopes to a depth of not less than six inches and remove large clods, stumps, roots larger than ½-inch in diameter and debris.

2. Sow seed within twenty-four (24) hours after the ground is scarified with either mechanical seed drills or rotary hand seeders.

3. Apply mulch loosely and to a thickness of between 3/4-inch and 1-1/2-inches.

4. Apply erosion control matting in addition to mulching on sloped surfaces greater than 4 to 1.

5. Roll and water seeded areas in a manner, which will encourage sprouting of seeds and growing of grass. Reseed areas which exhibit unsatisfactory growth. Backfill and seed eroded areas.

5. Refer Section 02985 for seeding and mulching requirements.

3.02 SEDIMENTATION CONTROL

A. Prior to clearing and/or grubbing and removal of vegetation and topsoil, Contractor shall initially repair and clean the existing sediment pond and leading channels and install new erosion and sedimentation control measures as specified and necessary to provide proper sedimentation and erosion control in compliance with NCDENR Land Quality Section, including, but not limited to silt fencing, sediment traps, drop inlet protection, diversion berms, ditches, riprap apron protection, sediment pond, and other appurtenances required by NCDENR Division of Land Quality.

B. Contractor shall clear and/or grub only enough area to install erosion and sedimentation control measures. Silt fence shall be installed as needed to insure against off-site runoff until all diversion structures are constructed and operational. Contractor is responsible for preventing migration of sediment into wetland areas, streams and adjacent properties during construction. All disturbed areas shall drain toward installed erosion and sedimentation control measures. Owner may stop all work on the project if a Notice of Violation is issued by the NCDENR Land Quality Section relating to Contractor's work, and such stoppage shall remain in effect until such violations are corrected to the satisfaction of the Land Quality Section.

3.03 PERFORMANCE

A. The Contractor shall be responsible for inspecting all erosion and sedimentation control features on weekly basis and after each rain event and reporting his findings on the Inspection Record form, which will be provided by the Engineer prior to commencement of the work.

B. Should any of the temporary erosion and sediment control measures employed by the Contractor fail to produce results which comply with the requirements of the State of North Carolina, Contractor shall immediately take whatever steps are necessary to correct the deficiency at his own expense.

C. Erosion evident within the limits of construction shall be the responsibility of the Contractor during the full Contract term and for the one (1) full year guarantee period. Areas subject to erosion during this time shall be fully restored to original or design conditions (as applicable) within ten (10) days of notice to the Contractor.

END OF SECTION

SECTION 02279

SCRIM REINFORCED TARP

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install scrim reinforced tarp in the locations shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. Section 02700: Drainage Materials.

1.03 SUBMITTALS

A. Within 30 calendar days following the Notice to Proceed, submit the following information in accordance with Section 01300:

1. Manufacturer's background information.

2. Information on factory size, equipment, personnel, number of shifts per day and production capacity per shift.

3. List of material properties and samples of scrim reinforced tarp with attached certified test results.

4. Manufacturer's quality control program and manual including description of laboratory facilities.

5. A list of ten completed facilities where the scrim reinforced tarp is used including:

   a. Name and purpose of facility, its location and date of installation.

   b. Name of owner, project manager, design engineer and installer.

   c. Tarp thickness and surface area.

   d. Information on performance of the facility.

6. Shop Drawing, including:

   a. Details of overlap and seaming of the tarp, anchoring, and other construction details as well as any variance or additional details that deviate from the Drawings.

7. Installation schedule.

8. A manual that specifically defines the quality control and quality assurance program during installation including manufacturer's installation instructions.

9. Copy of quality control certificates in conformance with Paragraph 2.03.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM D638 – Standard Test Method for Tensile Properties of Plastics.

2. ASTM D751 – Standard Method for Testing Coated Fabrics.

3. ASTM D1238 – Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer.

4. ASTM D1505 – Standard Test Method for Density of Plastics by the Density-Gradient Technique.

5. ASTM D1603 – Standard Test Method for Carbon Black Content in Olefin Plastics.

6. ASTM D1777 – Standard Test Method for Thickness of Textile Materials

7. ASTM D4533 – Standard Test Method for Trapezoid Tearing Strength of Geotextiles

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 SYSTEM DESCRIPTION

A. The scrim reinforced tarp shall be installed over the drainage layer of the liner system in the areas as shown in the Drawings.

1.06 DELIVERY, STORAGE AND HANDLING

A. The scrim reinforced tarp shall be shipped, stored and handled in accordance with manufacturer's recommendations.

B. The tarp shall be stored such that it is protected from exposure to sunlight and it shall be elevated from the ground (a minimum of 3-in) to protect the tarp from puncture and soil staining.

1.07 PROJECT/SITE REQUIREMENTS

A. The sand drainage layer shall be surveyed and the geoelectric leak survey performed prior to installation of the tarp.

1.08 MATERIAL WARRANTY

A. The tarp manufacturer shall warrant the material, against manufacturing defect and material degradation (on a prorated basis) for a period of three years from the date of installation. The manufacturer shall replace any material which fails from the above causes within the warranty period. The manufacturer shall furnish a written warranty covering the requirements of this Paragraph.

1.09 GUARANTEE

A. The Contractor shall guarantee the tarp against defects in installation and workmanship for the period of two years commencing with the date of Final Acceptance. The guarantee shall include the services of qualified service technicians and all materials required for the repairs at no expense to the Owner.

PART 2: PRODUCTS

2.01 GENERAL

A. The use of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration.

2.02 MATERIALS

A. Scrim reinforced tarp shall be manufactured from a virgin polyethylene. The tarp shall be produced by laminating two sheets of high strength polyethylene film with a black layer of molten polyethylene. A layer of 900 denier polyester scrim reinforcement laid in a diagonal pattern spaced 3/8" apart with an additional machine direction scrim every 3" across the width shall be placed between the sheets.

B. The up side of the tarp shall be black and contain UV inhibitors and thermal stabilizers.

C. The tarp shall conform to the following minimum properties

Properties	Minimum Value	Test Method
Thickness	0.012 inches (nominal)	ASTM D1777
Weight Per MSF	60 lbs.	
Tensile Strength	59 lbf.	ASTM D751
Elongation Break	650%	ASTM D751
Grab Tensile	90 lbf	ASTM D751
Trapezoid Tear	72 lbf	ASTM D4533
Hydrostatic Resistance	100 psi	ASTM D751

Maximum Use Temp. 180 F

Minimum Use Temp. -70 F

D. The scrim reinforced tarp shall be Dura-Skrim 12BV by Raven Industries or equal.

2.03 QUALITY CONTROL DOCUMENTATION

A. Prior to installation commencement of any tarp material, the Contractor shall provide to the Owner the following information certified by the manufacturer for the delivered tarp.

1. Each roll or panel delivered to the Project site shall have the following identification information:

- Manufacturer's name
- Product identification
- Roll or panel number
- Roll or panel dimensions

2. Quality control certificates, signed by the manufacturer's quality assurance manager. Each certificate shall have roll or panel identification number, sampling procedures, frequency and test results. At a minimum the following test results shall be provided every 100,000 square feet of manufactured tarp in accordance with test requirements specified in Paragraph 2.02.

- Resin Density
- Resin Melt Index
- Thickness
- Carbon Black Content

2.04 CONFORMANCE TESTING

A. Conformance testing shall be performed by an independent testing laboratory retained by the Contractor. The Engineer will obtain samples from the delivered material, mark the machine direction and identification number. One sample shall be taken per 100,000 square feet of material, or one sample per lot, whichever results in the greater number of conformance tests. This sampling frequency may be increased as deemed necessary by the Engineer. The following conformance tests shall be conducted at the laboratory:

1. Resin Density (ASTM D1505)
2. Carbon Black Content (ASTM D1603)
3. Melt Index (ASTM D1238)
4. Thickness (ASTM D1777)
5. Tensile Strength (ASTM D751)

B. These conformance tests shall be performed in accordance with test requirements specified in Paragraph 2.02.

C. All conformance test results must be approved by the Engineer prior to the deployment. All test results shall meet, or exceed, the property values listed in Paragraph 2.02. In case of failing test results, the Contractor may request that other samples be retested with the manufacture present during the testing procedures. The costs for retesting including engineering, analyses and all associated expenses shall be paid for by the Contractor. The Contractor may also have the sample retested at two different laboratories approved by the Owner. If both laboratories report passing results, the material shall be accepted. If both laboratories do not report passing results, all material from the lot representing the failing sample will be considered out of specification and rejected. The manufacturer may obtain additional samples from rolls or panels immediately before and after the failing roll or panel or as directed by the Engineer and have them tested at no expense to the Owner. If these rolls or panels pass, then only the failing roll or panel will be rejected. If they fail, then the entire lot will be rejected.

PART 3: EXECUTION

3.01 PREPARATION

A. General
Prior to installation, the following actions shall occur:

1. The sand protective layer shall be surveyed to confirm sufficient depth.

2. The geoelectric survey shall be performed to ensure that no damage occurred to the liner system during installation of the sand layer.

3. The sand layer shall inspected by the Engineer for compliance with the specifications.

2. The Contractor shall confirm all testing for the protective cover has been performed and the results meet the requirements of the specifications.

3.02 INSTALLATION

A Panel Placement

1. Care shall be taken to keep the tarp clean and free from debris prior to installation.

2. The tarp shall be installed in such a manner as to ensure that it is not damaged in any way. The following procedures shall be complied with during installation:

a. The tarp shall be weighted with 50 lb sandbags placed every 10 feet on center across the width direction and 5 feet on center on the length direction. Such sandbags shall be installed immediately after placement of the tarp.

b. Sandbags shall be made with UV resistant material that is better or equal to the UV resistance of the tarp.

c. When material must be deployed on windy days short sections must be pulled out and immediately secured with sand bags prior to moving on to the next sections

d. Care shall be taken not to leave tools on the tarp.

3. Weather Conditions:

a. Tarp installation shall not proceed at an ambient temperature below 40 degrees F or above 104 degrees F unless otherwise authorized, in writing, by the Engineer or his/her field representative.

b. Tarp installation shall not be performed during precipitation, excessive moisture, in an area of ponded water, or excessive winds.

B. Method of Placement

1. Each tarp panel shall be installed in accordance with the approved shop drawings prepared by the Manufacturer. The layout shall be designed to keep field joining to a minimum and consistent with proper methods of installation.

2. The equipment used to deploy the tarp shall not cause excessive rutting of the sand surface. Excessive rutting is defined as more than 6-inches. If rutting occurs, the Contractor shall suspend all tarp placement activities and repair the ruts and immediately employ an alternative method for tarp deployment.

3. The Engineer shall inspect each panel, after placement and prior to seaming, for damage and/or defects. Defective or damaged panels shall be replaced or repaired, as approved by the Engineer.

4. Personnel working on the tarp shall not smoke, wear damaging shoes or involve themselves in any activity that may damage the tarp.

5. Vehicular traffic across the tarp shall not be allowed with the exception of a low ground pressure all-terrain vehicle that exerts a maximum pressure of 6 psi. Use of a low ground pressure all-terrain vehicle will be revoked if it demonstrated to cause damage. Additionally, no machinery or equipment shall be allowed on the tarp without prior approval from the Engineer.

6. The tarp shall be kept free of debris, unnecessary tools and materials. In general, the tarp area shall remain uncluttered in appearance.

3.03 FIELD SEAMS

A. Individual panels of tarp or multiple panels that are factory welded shall be laid out and overlapped by a minimum of 4-in prior to seaming. The uphill panel shall be placed over the downhill panel similar to roof shingling in order to limit leakage. The area to be seamed shall be cleaned and prepared in accordance with the installer's quality control seaming procedures.

B. The seams shall be fusion welded.

3.04 SEAMING WEATHER CONDITIONS

A. Normal Weather Conditions

1. The normal required weather conditions for seaming are:

   a. Ambient temperature higher than 40 degrees F and lower than 104 degrees F.

   b. No precipitation or other excessive moisture, such as fog or dew.

   c. No excessive winds.

2. These weather conditions shall be fulfilled during the seaming process.

3.05 FIELD QUALITY CONTROL

A. Repair Procedures

1. Any portion of the tarp exhibiting signs of damage or defect shall be repaired. Several procedures exist for the repair of these areas. The final decision, as to the appropriate repair procedure, shall be made by the Engineer.

2. The repair procedures available include:

   a. Patching, used to repair large holes, tears, undispersed raw materials and contamination by foreign matter.

   b. Capping, used to repair large lengths of failed seams.

B. Repair Verification

1. The Contractor shall have all repairs reviewed by the Engineer.

3.06 DISPOSAL OF WASTE MATERIAL

A. Upon completion of installation, the Contractor shall dispose of all trash, waste material and equipment used in connection with the performed work and shall leave the premises in a neat and acceptable condition.

END OF SECTION

SECTION 02612

REINFORCED CONCRETE PIPE AND FITTINGS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, equipment, materials and incidentals necessary to install and reinforced concrete pipe and fittings for storm water conveyance as shown on the Drawings and as specified herein.

B. All pipes shall be manufactured for this project and no pipe shall be furnished from stock.

C. This work shall include, but not be limited to installing reinforced concrete pipe including all excavation, backfilling, sheeting, slope protection, drainage, concrete work, riprap, grading and all other work necessary to complete the construction, installation and testing of the reinforced concrete pipe.

1.02 RELATED WORK

Related work includes, but is not limited to, the following:

A. Section 02200: Excavation, Backfill and Compaction.

1.03 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM C33 - Standard Specification for Concrete Aggregates

2. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe

3. ASTM C150 - Standard Specification for Portland Cement

4. ASTM C443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets (2005)

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.04 QUALIFICATIONS

A. All reinforced concrete pipe and fittings shall be furnished by a single manufacturer who is fully experienced, reputable and qualified to manufacture the pipe to be furnished.

B. Reinforced concrete pipe and fittings shall conform to all applicable ASTM Standards and these specifications.

1.05 SUBMITTALS

A. Submit to the Engineer within 30 days after receipt of Notice to Proceed, a list of materials to be furnished, the names of the suppliers, and the date of delivery of materials to the site.

B. Submit shop drawings to the Engineer for review in accordance with Section 01300, including all fittings along with the manufacturer's drawings and specifications indicating complete details of all items. The pipe details shall include pipe class or design and backup computations including reinforcement; class coding, joints, and list of abbreviated terms with their full meaning. The above shall be submitted to the Engineer for approval before fabrication and shipment of these items. The locations of all pipes shall conform to the locations indicated on the Drawings. In most cases, a certain amount of flexibility in positioning of pipes will be allowed, especially where new pipes will connect to existing structures or piping. Horizontal and vertical deflections may require beveled, special deflection, or short pipe. The deflection of joints shall not exceed 75 percent of that recommended by the manufacturer.

C. The pipe manufacturer shall inspect all pipe joints for out-of-roundness and pipe ends for squareness. The manufacturer shall furnish to the Engineer a notarized affidavit stating all pipe meets the requirements of ASTM, ASCE, ANSI, AWWA, etc., these Specifications, and the joint design with respect to square ends and out-of-round joint surfaces.

D. Furnish in duplicate to the Engineer sworn certificates that all tests and inspections required by the Specifications under which the pipe is manufactured have been satisfied.

1.06 INSPECTION

A. All pipe and fittings to be installed under this contract may be inspected at the site of manufacture for compliance with these Specifications by an independent laboratory selected by the Owner. The manufacturer's cooperation shall be required in these inspections. The cost of inspection, by an independent laboratory, will be borne by the Owner.

PART 2 PRODUCTS

2.01 REINFORCED CONCRETE PIPE

A. Except as otherwise specified herein or as indicated on the Drawings, pipe shall conform to ASTM C76, Standard Specifications for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe. Pipe shall be Class IV Wall B.

B. The pipe shall be capable of withstanding construction equipment loading which may be encountered during the progress of the work. Any pipe damage during construction operations shall be promptly and satisfactorily repaired or replaced at the Contractor's expense.

C. Non-air-entraining portland cement conforming to ASTM C150, Type II shall be used, except as otherwise approved in writing by the Engineer. The use of any other admixture will not be permitted.

D. Fine aggregate shall consist of washed inert natural sand conforming to the requirements of ASTM C33, except for gradation, with a maximum loss of 8 percent when subjected to five cycles of the soundness test using magnesium sulfate.

E. Coarse aggregate shall consist of well-graded crushed stone or washed gravel conforming to the requirements of ASTM C33, except for gradation, with a maximum loss of 8.0 percent when subjected to five cycles of the soundness test using magnesium sulfate.

F. The 28-day compressive strength of the concrete shall be not less than 4,000 psi. The pipe interior shall comprise a continuous integral cement skin and shall be smooth and even, free from roughness, projections, indentations, offsets or irregularities. The concrete mass shall be dense and uniform. The average absorption for the drainage pipe shall not exceed 5.0 percent of the dry weight and no specimen shall exceed 9.0 percent. Reinforcement in the bell and spigot shall be adequate to prevent damage to concrete during shipping, handling and installation.

G. The pipe shall be clearly marked as required by ASTM C76 in a manner acceptable to the Engineer. The markings may be at either end of the pipe for the convenience of the manufacturer, but for any one size shall always be at the same end of each pipe length. Pipe shall not be shipped until the compressive strength of the concrete has attained 3,000 psi and not before five (5) days after manufacture, and/or repair, which ever is the longer.

H. Piping shall have a minimum laying length of approximately 8 feet, except for closure and other special pieces as approved by the Engineer. The length of the concrete pipe at each structure shall be as shown but in any case, shall not exceed 3 feet.

I. Unsatisfactory or damaged pipe will be either permanently rejected or returned for minor repairs. All pipe which has been damaged after delivery will be rejected. If damaged pipe already has been laid in the trench it shall be acceptably repaired or removed and replaced at the sole discretion of the Engineer entirely at the Contractor's expense. Pipe may be rejected for any of the following reasons:

   1. Exposure of any wires and positioning spacers or chairs used to hold the reinforcement cage in position, or steel reinforcement in any surface of pipe, except for ends of longitudinal reinforcing. Type 304 stainless steel chairs and spacers may be used in lieu of this requirement.

   2. Transverse reinforcing steel found to be in excess of 1/4-inch out of specified position after the pipe is molded.

   3. Any shattering or flaking of concrete at a crack.

   4. Air bubble voids (bugholes) on the interior and exterior surfaces of the pipe exceeding 1/4-inch in depth unless properly and soundly filled with mortar or other approved material.

   5. Unauthorized application of any wash coat of cement or grout.

   6. A hollow spot (identified by tapping the internal surface of the pipe) which is greater than 3 inches in length or wider than 3 times the specified wall thickness. Repair of such defective areas not exceeding these limitations may be made.

7. Defects that indicate imperfect molding of concrete; or any surface defect indicating honeycomb or open texture (rock pockets) greater in size than an area equal to a square with a side dimension of 2-1/2 times the wall thickness or deeper than two times the maximum graded aggregate size or local deficiency of cement resulting in loosely bonded concrete, the area of which exceeds in size the limits or area described in Paragraph 6 above, when the defective concrete is removed. Repair of such defects not exceeding these limits may be made as provided in Paragraph 6 above.

8. Any of the following cracks:

   a. A crack having a width of 0.005 inch to 0.01 inch throughout a continuous length of 36 inches or more.

   b. A crack having a width of 0.01 inch to 0.03 inches or more throughout a continuous length of 1 foot or more.

   c. Any crack greater than 0.005 inch extending through the wall of the pipe and having a length in excess of the wall thickness.

   d. Any crack showing two visible lines of separation for a continuous length of 2 feet or more, or an interrupted length of 3 feet or more anywhere in evidence, both inside and outside.

   e. Cracks anywhere greater than 0.03 inch in width.

9. Transverse reinforcing steel found to be in excess of 1/4-inch out of specified position after the pipe is molded.

10. A deficiency greater than 1/4-inch from the specified wall thickness of pipe 30 inches or smaller in internal diameter.

11. A deficiency greater than 6 percent from the specified wall thickness of pipe larger than 30 inches in internal diameter, except that the deficiency may be 8 percent adjacent to the longitudinal form joint, provided that the additional deficiency does not lie closer than 20 percent of the internal diameter of the pipe. The deficiencies in wall thickness permitted herein do not apply to gasket contact surfaces in gasketed joint pipe.

12. A variation from the specified internal diameter in excess of 1 percent, or interior surfaces which have been reworked after placing of concrete. The variation in internal diameter permitted herein does not apply to gasket contact surface in gasketed joint pipe.

J. Pits, blisters, rough spots, breakage, and other imperfections may be repaired, subject to the approval of the Engineer, after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final approval. Non-shrink cement mortar used for repairs shall have a minimum compressive strength of 6,000 psi at the end of 7 days and 7,000 psi at the end of 28 days, when tested in 3-inch cylinders stored in the standard manner. Epoxy mortar may be utilized for repairs subject to the approval of the Engineer.

K. Joints for concrete pipe less than 48 inches in diameter shall be the tongue and groove or bell and spigot type of joint with provisions for using a round rubber "O-Ring" gasket in a recess in the

spigot end of the pipe. The bevel on the bell of the pipe shall be between 1-1/2 degree and 2-1/2 degree and the annular open space at the gasket when the joint is made up and pipes are centered and in line shall not exceed 3/16-inch. The diameters of the joint surfaces which compress the gasket shall not vary from the true diameters by more than 1/16-inch. The faces of pipe in contact with the gasket shall be true, and free of irregularities.

1. The round rubber "O-Ring" gaskets shall conform to ASTM C443 Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, using Rubber Gaskets.

2. The manufacturer shall supply test data and affidavits showing compliance with these requirements. Tests shall have been conducted within six months of the start of manufacture of the pipe.

3. The pipe manufacturer shall furnish information and supervise the installation of at least the first five joints installed by the Contractor. The ends of the pipe shall be made true to form and dimension by casting against steel forms.

L. Reinforced concrete bends shall be cast to the degree of curvature required or fabricated by cutting the pipe at the required angle and then rejoining the sections. Bends may be smooth or mitered providing mitered angles do not exceed 22-1/2 degrees and bends have a radius divided by the pipe diameter greater or equal to one.

M. Joints for concrete pipe 48 inches in diameter and larger shall be of the rubber and steel joint design utilizing a steel bell, a steel spigot, a round rubber gasket and meeting the requirements of ANSI/AWWA C301. Steel skirts shall be welded to the spigot ring and adequately welded to internal reinforcing. The steel in the bells shall be adequate to resist cracking the concrete during installation. Before the first pipe is shipped, the manufacturer shall make a fit-up test in the presence of the Engineer.

PART 3 EXECUTION

3.01 GENERAL

A. Care shall be taken in loading, transporting, and unloading to prevent injury to the pipe or coatings. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before laying, and no piece shall be installed which is found to be defective. Any damage to the pipe coatings shall be repaired as directed by the Engineer.

B. All pipe and fittings shall be subjected to a careful inspection and hammer test just prior to being laid or installed. If any defective pipe is discovered after it has been laid it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional expense to the Owner. All pipe and fittings shall be thoroughly cleaned before laying, shall be kept clean until they are used in the work, and when installed or laid, shall conform to the lines and grades required.

C. All buried piping shall be installed to the lines and grades as shown on the Drawings. All underground piping shall slope uniformly between joints where elevations are shown.

D. All pipe shall be sound and clean before laying. When laying is not in progress the open ends of the pipe shall be closed by watertight plugs or other approved means.

E. Bevel and short pipe shall be used as necessary to meet site conditions and to provide a pipe installation as shown in the Drawings. The cost of all such pipe shall be included within the bid price for the pipe.

3.02 REINFORCED CONCRETE PIPE

A. As soon as the excavation is completed to the normal grade required, the Contractor shall immediately place sand bedding material in the trench, and then the pipe shall be firmly bedded in the sand to conform accurately to the lines and grades indicated on the Drawings. Bedding material for bedding the pipe shall conform to the specifications under Section 02200.

B. Bedding material, as specified, shall be placed and compacted to give complete vertical and lateral support for the lower section of the pipe. A depression shall be left in the bedding material at the joint to prevent bedding material from entering the bell and interfering with seating the spigot or contaminating the gasket. Before the pipe is lowered into the trench, the spigot and bell shall be clean and free from dirt. As soon as the spigot is centered in the bell of the previously laid pipe, it shall be forced home smoothly and evenly with a pipe jack or other similar equipment. The pipe jack shall be anchored sufficiently so that the pulling force will not dislodge the pieces of the pipe already in place. If necessary, the Contractor shall employ hand methods of pipe joining. For example, the pipe may be forced home by using come-alongs or by the proper manipulation of a backbone and cable sling. The Contractor shall be responsible for any damage to pipe ends due to improper pipe homing techniques and shall promptly repair or replace any pipe so damaged at no cost to the Owner.

C. The gasket and bell shall be lubricated by a vegetable lubricant, which is not soluble in water, furnished by the pipe manufacturer and harmless to the rubber gasket. Each gasket shall be carefully checked for proper positioning around the full circumference of the joint. Special measures shall be taken to ensure that the gaskets are properly positioned. For example, steel inserts may be required to prevent the pipe from going home until a feeler gauge is used to check the final position of the gasket, with special attention being given to the bottom half of the pipe.

D. As soon as the pipe is in place and before the jack, come-along or sling is released, backfill shall be placed and compacted to the mid-diameter point for at least one-half the length of the pipe. Not until this backfill is placed shall the jack, come-along or sling be released. If motion at any joint is detected, more compacted backfill shall be placed before pressure is released.

E. Following full joint insertion, the space outside of the gasket shall be immediately filled with grout, followed by full joint grouting in accordance with the pipe manufacturer's recommendations.

F. A cloth joint band or diaper held with wires shall be placed to cover the outside joint and prevent the entrance of dirt. Grout composed of one part cement to two parts of well-graded mason's sand shall be poured into the outside joint on one side of the pipe to at least the springline. Placing mortar with hand tools may be done with the upper half of the joint. Grout must fill the entire joint. All exposed metal surfaces of appurtenances shall be covered with a minimum of 3/4-inch of cement grout all around.

G. The Contractor shall have the option of using joint filler approved by the Engineer in place of the diaper-grout operation, except for restrained joints.

3.03 STRUCTURE AND MANHOLE CONNECTIONS

A. Pipe stubs for all structure and manhole connections shall not exceed 2 feet in length.

3.04 TESTING (Not Used)

3.05 CLEANING

A. At the conclusion of the work, thoroughly clean all pipelines by flushing with water or other means to remove all dirt, stones, pieces of wood, or other material which may have entered the pipes during the construction period. Debris cleaned from the lines shall be removed from the low end of the pipeline. If after this cleaning, obstructions remain, they shall be removed. After the pipelines are cleaned and if the groundwater level is above the pipe or following a heavy rain, the Engineer will examine the pipes for leaks. If any defective pipes or joints are discovered, they shall be repaired.

END OF SECTION

SECTION 02623

HIGH DENSITY POLYETHYLENE (HDPE) PIPE

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install high density polyethylene (HDPE) leachate pipe, fittings and appurtenances as shown on the Drawings and as specified herein.

1.02 RELATED WORK

Related work includes, but is not limited to, the following:

A. Section 02200: Excavation, Backfill, and Compaction.

B. Section 02700: Drainage Materials.

C. Section 02776: High Density Polyethylene (HDPE) Liner.

1.03 SUBMITTALS

A. Within 15 days following the Effective Date of the Agreement, submit the following information in accordance with Section 01300:

1. List of materials to be furnished, the names of the suppliers and the date of delivery of materials to the site.

2. The origin of the resin to be used in the manufacturing of the pipe including the suppliers name and production plant, as well as brand name and number.

3. Documentation from the resin's manufacturer showing results of the following tests for resin identification:

a. Melt Flow Index ASTM D1238

b. Density ASTM D1505

4. Manufacturer quality control manual describing implementation of quality control procedures during pipe manufacturing process.

5. Pipe manufacturer's certification of compliance with these Specifications.

6. Complete, detailed shop drawings of all polyethylene pipe, including the location of all fittings, joints and connections to structures.

7. Manufacturer's recommendations for handling, storing and installing pipe and fittings.

8. For each shipment of pipe, a manufacturer's certification that the pipe was manufactured from the same resin identified in Paragraph 1.03A.2.

9. Certification demonstrating that the joining technician was trained by the pipe manufacturer and is qualified to perform heat fusion welding.

10. Cleaning and video inspection Contractor qualifications for the new leachate piping that comply with Paragraphs 3.03 A and B.

1.04 REFERENCE STANDARDS

Referenced standards include, but are not limited to, the following:

A. American Society for Testing and Materials (ASTM)

1. ASTM D1238 - Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer.

2. ASTM D1248 - Standard Specification for Polyethylene Plastic Molding and Extrusion Materials.

3. ASTM D1505 - Standard Test Method for Density of Plastic by the Density- Gradient Technique.

4. ASTM D1603 - Standard Test Method for Carbon Black in Olefin Plastics

5. ASTM D2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.

6. ASTM D2837 - Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.

7. ASTM D3350 – Standard Specification for Polyethylene Plastic Pipe and Fitting Materials.

8. ASTM F714 - Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. Resin Evaluation

1. All incoming resin shall be sampled for conformance testing against test results supplied by the resin manufacturer. Samples shall be taken from the top and bottom of each compartment from every hopper car received. The following conformance tests shall be performed on the sample:

   a. Melt Flow Index ASTM D1238

   b. Density ASTM D1505

   c. The results of these tests shall become part of the manufacturer's permanent quality control records.

B. Finished Product Evaluation

1. Each length of pipe produced shall be checked by production staff for the items listed below. The results of all measurements shall be recorded on production sheets which become part of the manufacturer's permanent records.

   a. Pipe in process shall be checked visually, inside and out for cosmetic defects (grooves, pits, hollows, etc).

   b. Pipe outside diameter shall be measured using a suitable periphery tape to ensure conformance with ASTM F714.

   c. Pipe wall thickness shall be measured at 12 equally spaced locations around the circumference at both ends of the pipe to ensure conformance with ASTM F714.

   d. Pipe length shall be measured.

   e. Pipe marking shall be examined and checked for accuracy.

   f. Pipe ends shall be checked to ensure they are cut square and clean.

   g. Subject inside surface to a "reverse bend test" to ensure the pipe is free of oxidation (brittleness).

C. Stress Regression Testing

1. The polyethylene pipe manufacturer shall provide certification that stress regression testing has been performed on the specific polyethylene resin being utilized in the manufacture of this product. This stress regression testing shall have been done in accordance with ASTM D2837 and the manufacturer shall provide a product supplying a minimum Hydrostatic Design Basis (HDB) of 1,600 psi as determined in accordance with ASTM D2837.

1.05 WARRANTY

A. The pipe material manufacturer shall provide an unconditional extended warranty for the pipe covering the cost of the materials for repair or replacement plus installation should the pipe fail within the warranty period. The manufacturer's extended warranty shall be for ten years after the final acceptance of the project by the Owner. The manufacturer shall guarantee that the pipe furnished is suitable for the purpose intended and free from defects of material and workmanship for the duration of the extended warranty. In the event the pipe fails to perform as specified, the pipe manufacturer shall promptly replace defective pipe at no cost to the Owner.

PART 2 PRODUCT

A. HDPE pipe resins shall be high molecular weight; high density polyethylene with a cell classification number of 345464C (black) / 345464E (color) in accordance with ASTM D3350.

B. The HDPE pipe shall be Performance Driscoplex 4600 as manufactured by Performance Pipe – Chevron Phillips Chemical Company LLC, or equal.

C. Materials used for the manufacture of polyethylene pipe shall meet the following physical property requirements.

PROPERTY	UNIT	TEST PROCEDURES	TYPICAL VALUE
Density	g/cm^3	ASTM D1505	0.955 (black) 0.947 (color)
Melt Index	g/10 minutes	ASTM D1238	0.1
Flexural Modulus	psi	ASTM D790	> 130,000
Tensile Strength	psi	ASTM D638	3,200
Hydrostatic Design Basis at 73.4° F (23° C)	psi	ASTM D2837	1,600
Carbon Black Stabilizer	percent	ASTM D3350	Black with min. 2% carbon black Color with UV stabilizer

D. All HDPE pipes shall have the nominal dimensions shown on the Drawings and shall meet the requirements of ASTM F714.

E. SDR Requirements for various HDPE pipes

PIPE	SDR
6" Leachate Collection Pipes	17
8" Leachate Header Pipe	17
2" x 4" Dual Containment Leachate Forcemain – Carrier pipe	11
2" x 4" Dual Containment Leachate Forcemain – Containment pipe	17
18" Primary and Secondary Slope Riser Pipes	17

F. Pipe shall be furnished in standard laying lengths not exceeding 50-ft.

G. All HDPE pipe and fittings shall be made from the same resin.

2.02 PIPE IDENTIFICATION

A. The following shall be continuously printed on the pipe or spaced at intervals not exceeding 5-ft:

1. Name and/or trademark of the pipe manufacturer.

2. Nominal pipe size.

3. Dimension ratio.

4. The letters PE followed by the polyethylene grade in accordance with ASTM D1248, followed by the hydrostatic design basis in 100's of psi, e.g., PE 3408

5. Manufacturing standard reference, e.g., ASTM F714.

6. A production code from which the date and place of manufacture can be determined.

2.03 PERFORATIONS

A. The leachate collection pipe inside lined areas shall be perforated. The perforations shall be drilled into the pipe at the factory after manufacturing. The perforated pipe shall have two rows of holes ½ inch in diameter on 6-inch centers, with allowable tolerances 1/16 -inch on the diameter plus 1/4-inch on the spacing. The rows shall be parallel to the axis of the pipe and 120 degrees (plus or minus 5 degrees) apart.

2.04 DUAL CONTAINMENT PIPE AND FITTINGS

A. Dimensions of the carrier pipe shall be in accordance with the following table to ensure adequate flow space for leak detection.

CARRIER/CONTAINMENT PIPE DIMENSIONS

	OD PIPE SIZE IN INCHES
CARRIER PIPE	2.375
CONTAINMENT PIPE	4.5

B. Dual containment pipe shall be delivered with the carrier pipe installed within the containment pipe with all necessary support spacers installed.

C. Unless otherwise specified, carrier to carrier joints and containment to containment joints shall be made using thermal fusion procedures. Thermal fusion welds shall be performed as recommended by the manufacturer.

2.05 SUPPORT SPACERS

A. Support spacers shall be manufactured from non-metallic, corrosion resistant material, or the same HDPE pipe grade material.

B. Support spacers shall be secured to the carrier pipe at intervals, as recommended by the manufacturer, to center the carrier pipe within the containment pipe.

C. Support spacers shall be designed and installed to provide satisfactory performance of the carrier and containment piping system due to thermal expansion and contraction.

PART 3 EXECUTION

3.01 INSTALLATION

A. High density polyethylene (HDPE) pipe shall be installed in accordance with the manufacturer's instructions, as shown on the Drawings and as specified herein. All heat fusion joints shall be done by a certified joining technician.

B. The internal fusion bead shall be removed from all riser, header and leachate collection pipes to provide unimpeded travel of the leachate pumps and video cameras. The internal fusion bead shall be removed and extracted from the pipe using a bead trimmer tool as manufactured by R&L Manufacturing, Inc. of Camas, WA or equal. The removal of the internal fusion bead shall be in accordance with the bead trimmer tool manufacturer's operations manual. The internal bead shall be removed during the cooling stages of the fusion process. Wall mass removal shall not exceed 1/10th of the pipe wall thickness; The Engineer will verify that the bead has been completely removed. If additional beads are encountered during video inspection, the Contractor will be required to remove it at no additional expense to the Owner. The extracted bead shall have a double roll back that is similar in appearance to the external bead and possess a smooth root cut.

C. Pipe shall be laid to the lines and grade shown on the Drawings with the appropriate bedding and backfill as shown on the Drawings. The pipe shall be installed such that perforations face the bottom of trench.

D. When installation is not in progress, the open ends of the pipe shall be closed by fabricated plugs, or by other approved means to protect against dirt, stone or other debris material from entering the pipe. All plugs shall be OD fitting type plugs. No plugs will be allowed that require insertion of the plug into pipe.

E. Pipe shall be stored on clean level ground to prevent undue scratching or gouging. The handling of the pipe shall be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. The maximum allowable depth of cuts, scratches or gouges on the exterior of the pipe is 10 percent of wall thickness. The interior pipe surface shall be free of cuts, gouges or scratches and deleterious materials.

F. Sections of pipe with cuts, scratches, or gouges deeper than allowed shall be removed completely and the ends of the pipeline rejoined.

G. The pipe shall be joined by the method of thermal butt fusion, as outlined in ASTM D2657. All joints shall be made in strict compliance with the manufacturer's recommendations. In tight locations in which the butt fusion equipment cannot be setup (ex. tie-in to bootless pipe penetration), a thermal coupling such as Central Electrofusion Systems or equal shall be used.

H. Mechanical connections of the polyethylene pipe to auxiliary equipment such as valves, pumps and tanks shall be through flanged connections which shall consist of the following:

- A stainless steel back-up, polyethylene flange shall be thermally butt-fused to the stub end of the pipe.

- A 316 stainless steel back up ring on both sides of the connection shall be used as a approved by the Engineer.

I. Flange connections shall be provided with a full face neoprene gasket.

J. All HDPE pipe must be at the temperature of the surrounding soil at the time of backfilling and compaction.

K. All installation of pipe must be observed and accepted by the Engineer's representative prior to any backfilling.

3.02 TESTING

A. All non-perforated pipe shall be field tested (with the exception of non-perforated cleanout piping). The Contractor shall supply all labor, equipment, material, gages, pumps, meters, and incidentals required for testing.

B. All non-perforated pipe shall be tested at a pressure of 130 psi. The test pressure shall be measured at the highest point along the test section by a recording type pressure gage and a copy of the readout shall be submitted to the Engineer upon completion of the test. All testing shall be conducted in the presence of the Engineer or his/her designated representative.

C. Testing shall be conducted after backfilling has been completed and before placement of permanent surface.

D. Testing procedure shall be as follows:

E. Fill line slowly with water. Maintain flow velocity less than two feet per second.

a. Expel air completely from the line during filling and again before applying test pressure.

b. Apply initial test pressure and allow to stand without makeup pressure for three hours, to allow for diametric expansion or pipe stretching to stabilize.

c. After this equilibrium period, apply the specified test pressure and turn the pump off. The final test pressure shall be held for three hours.

d. Upon completion of the test, the pressure shall be bled off from a location other than the point where the pressure is monitored. The pressure drop shall be witnessed by the Engineer at the point where the pressure is being monitored and shall show on the recorded pressure readout submitted to the Engineer.

F. Allowable amount of makeup water for expansion during the pressure test shall conform to Table 5, Allowance for Expansion Under Test Pressure, Technical Report TR 31/88, published by the Plastic Pipe Institute (PPI). If there are no visual leaks or significant pressure drops during the final test period, the installed pipe passes the test.

G. If any test of pipe laid disclosed leakage or significant pressure drop greater than that allowed, the Contractor shall, at his/her own expense, locate and repair the cause of leakage and retest the line.

H. All visible leaks are to be repaired regardless of the amount of leakage.

3.03 CLEANING AND VIDEO INSPECTION

A. Prior to substantial completion of Project, thoroughly clean, by means of high pressure water jet, all of the proposed leachate collection and header pipe lines to remove all dirt, stones, pieces of wood, HDPE pipe shaving pieces or other material which may have entered during the construction period. If, after this cleaning, any obstructions remain, they shall be removed. Cleaning of the leachate and header pipes shall be conducted by a qualified Contractor (such as Florida Jetclean Inc.) experienced in working within landfill environments. All proposed leachate pipes shall be completely cleaned as a requirement for Substantial Completion.

B. Prior to Substantial Completion, all proposed and existing leachate collection and header pipes shall be subject to video camera inspection by the Contractor under the observation of the Owner and Engineer. It is the intent to video leachate pipes to locate pipe defects, deviations to gradient, and clogs. When this inspection is performed, the Contractor shall be responsible for preparing the pipes for inspection and furnishing labor as required at no expense to the Owner. Video inspections of the leachate collection and header pipes shall be conducted by a qualified contractor (such as Florida Jetclean Inc.) experienced in working within landfill environments. Color video tape (one copy each) or DVD recordings of the completed leachate pipes shall be provided to the Owner and Engineer as a permanent record. Each video tape shall have an audio and written log of that video tape's contents. Refer to specification Section 01390 for audio and log contents.

C. Video camera system shall be capable of accessing the leachate collection and header lines from the proposed and existing cleanouts. Video camera equipment utilized to inspect the existing leachate pipes must comply with the requirements of Class 1, Division 1 Groups C&D of the National Electrical Code Section NFPA 70.

D. The recordings shall be properly exposed and the camera shall be in proper focus so that good, clear recordings showing detail are produced. Recordings shall be identified by audio recordings noting the leachate pipe, any leaks, cracks, or pipe defects. Video tapes or DVDs (original and one copy) of the completed leachate pipes shall be delivered to the Engineer. The Contractor shall provide any assistance required by the Engineer to assist the Engineer with visual inspections.

END OF SECTION

SECTION 02624

CORRUGATED HIGH DENSITY POLYETHYLENE (HDPE)
DRAINAGE PIPE AND FITTINGS

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required to install dual wall corrugated HDPE pipe, flared end sections and appurtenances as shown on the Drawings and as specified herein.

1.02 RELATED WORK

Related work includes, but is not limited to, the following:

A. Section 02200: Excavation, Backfill and Compaction.

1.03 SUBMITTALS

A. Submit the following information in accordance with Section 01300:

1. Complete detailed shop drawings of the corrugated HDPE pipe, including fittings and joints.

2. Manufacturer's recommendations for handling, storing and installing pipe and fittings.

3. Manufacturer's test data showing that the pipe delivered meets or exceeds the published product data.

1.04 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials (AASHTO)

1. AASHTO M-294 - Standard Specification for Corrugated Polyethylene Pipe (12-in to 36-in)

B. American Society for Testing and Materials (ASTM)

1. ASTM D1557 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3(2,700 kN-m/m^3))

2. ASTM D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Application.

3. ASTM D3212 –Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

4. ASTM F477 –Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

5. ASTM F667 – Standard Specification for Large-Diameter Corrugated Polyethylene Pipe and Fittings

C. Where reference is made to one of the above standards the revision in effect at the time of bid opening shall apply.

1.05 QUALIFICATIONS

A. The polyethylene pipe shall be furnished by a manufacturer who is fully experienced, reputable, and qualified in the manufacture of the polyethylene pipe. The pipe shall be designed, constructed, and installed in accordance with the best practices and methods and shall comply with this Section.

1.06 WARRANTY

A. The manufacturer shall warrant that the pipe shall be of merchantable quality (as defined by the Uniform Commercial Code). The manufacturer shall guarantee that the pipe furnished is suitable for the purpose intended and free from defects of material and workmanship. In the event the pipe fails to perform as specified, the pipe manufacturer shall promptly replace defective pipe without any cost to the Owner.

PART 2: PRODUCTS

2.01 CORRUGATED HDPE PIPE AND FLARED END SECTIONS

A. Corrugated HDPE pipe shall be dual wall with an annular corrugated exterior and smooth inner wall.

B. Corrugated pipe, flared end sections, appurtenances, and all couplings shall be high density polyethylene of the size and type as shown on the Drawings, all manufactured by the same company and shall meet or exceed the following specifications: AASHTO M-294; ASTM F667 and ASTM D2321.

C. Backfilling over the pipe shall be to the pipe manufacturer's specifications. Cover shall be compacted to at least 90 percent of its maximum dry density as determined by ASTM Test D1557, Method D.

D. Joints shall be watertight joints specified to meet a laboratory pressure test of 10.8 psi per ASTM D3212. The joints shall be bell and spigot or bell-bell design and incorporate an ASTM F477 elastomeric rubber gasket. Joints shall be ADS Pro-Link WT or equal.

PART 3: EXECUTION

3.01 INSTALLATION OF HDPE DRAINS

A. All pipe shall be examined before laying and no piece shall be installed which is found to be defective.

B. Pipe placement shall commence at the outlet and proceed section by section "uphill" unless otherwise directed by the Engineer.

C. If any defective pipe is discovered after installation, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional cost to the Owner. All pipe and fittings shall be thoroughly cleaned before installation, shall be kept clean until they are used in the work and when laid, shall conform to the lines and grades required.

D. Installation shall be per manufacturer's recommendation or as otherwise provided herein or on the Drawings.

E. All pipe shall be sound and clean before installation. Good alignment shall be preserved during installation. The deflection at joints shall not exceed that recommended by manufacturer.

F. Before any joint is made, the pipe shall be checked to assure that a close joint with the next adjoining pipe has been maintained and that the inverts are matched and conform to the required grade. The pipe shall not be driven down to grade by striking it.

G. Precautions shall be taken to prevent flotation of the pipe in the trench.

H. When moveable trench bracing such as trench boxes, moveable sheeting, shoring or plates are used to support the sides of the trench, care shall be taken in placing and moving the boxes or supporting bracing to prevent movement of the pipe, or disturbance of the pipe bedding and the backfill. Trench boxes, moveable sheeting, shoring or plates shall not be allowed to extend below top of the pipe. If trench boxes, moveable sheeting, shoring or plates have been installed below the top of the pipe, they shall be moved slowly taking care not to disturb pipe, bedding or backfill. As trench boxes, moveable sheeting, shoring or plates are moved, pipe bedding shall be placed to fill any voids created and the backfill shall be recompacted to provide uniform side support for the pipe.

I. Contractor shall be careful not to damage underlying geosynthetic components during pipe installation. Any damage shall be immediately repaired in accordance with the Specifications.

END OF SECTION

SECTION 02700

DRAINAGE MATERIALS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and incidentals required and install the protective cover layer associated with the leachate collection system over the HDPE base liner as shown on the Drawings and as specified herein. Associated work includes testing, sample collection, excavation, loading, shipping, delivering, stockpiling, and installation of protective cover materials.

B. The drainage materials consist of 24-inch of protective cover placed over the composite drainage net, a 10-inch secondary sand drainage layer on top of the secondary sand geomembrane and washed stone wrapped in filter fabric surrounding the leachate and gas collection and header pipes. The 10 inches secondary sand drainage layer and the 24 inches protective cover shall be the same material as specified herein. The locations of leachate collection pipes and associated details are indicated on the Drawings. The leachate collection pipes, fabric cushion, composite drainage net, and filter fabric are specified in the Sections listed in Paragraph 1.02.

1.02 RELATED WORK

A. Section 02200: Excavation, Backfill, and Compaction.

B. Section 02271: Fabric Cushion.

C. Section 02272: Filter Fabric.

D. Section 02274: Composite Drainage Net.

E. Section 02623: High Density Polyethylene (HDPE) Pipe.

F. Section 02776: High Density Polyethylene (HDPE) Liner.

1.03 SUBMITTALS

A. Within 15 calendar days following the Effective Date of the Agreement and before furnishing and installing the protective cover, the Contractor shall submit the following information in accordance with Section 01300:

2. A 5-gallon bucket sample.

3. Test results and other documentation as necessary to verify that proposed materials meet the requirements of Paragraph 2.01 of this Section.

4. Signed certifications from the suppliers, with permit numbers and types, that the granular fill sources are in full compliance with applicable standards and regulations.

4. A schedule and description of the installation procedures and equipment for the protective cover layer and leachate collection system.

5. A Quality Control/Quality Assurance Plan for the protective cover layer and leachate collection system installation.

6. Documentation and related past experience in accordance with Paragraph 1.06.

B. Within three weeks after completion of the protective cover layer and leachate collection system installation, the Contractor shall submit to the Engineer a survey plan certified by a Land Surveyor Registered in the State of North Carolina showing the elevations of the top of the protective cover layer.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM C33 - Standard for Concrete Aggregate.

2. ASTM C40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.

3. ASTM C136 - Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

4. ASTM C289 - Standard Test Method for Potential Alkali-silica Reactivity of Aggregates (Chemical Method).

5. ASTM D75 - Standard Practice for Sampling Aggregates.

6. ASTM D422 - Standard Test Method for Particle-Size Analysis of Soils.

7. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).

8. ASTM D854 - Standard Test Method for Specific Gravity of Soil Solids by Water Pycnometer.

9. ASTM D2434 - Permeability of granular soils (constant head).

10. ASTM D3042 - Standard Test Method for Insoluble Residue in Carbonate Aggregate.

12. ASTM D4373 - Standard Test Method for Rapid Determination of Carbonate Content of Soils.

13. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY CONTROL/QUALITY ASSURANCE

A. Materials to be incorporated into the project shall be subject to conformance testing by a Quality Control Laboratory (QCL) employed by the Contractor but approved by the Owner and Engineer prior to placement during construction.

B. The Owner may engage a Quality Assurance Laboratory (QAL) for the quality assurance testing to verify conformance test data provided by the QCL. Owner shall pay for these additional services. Contractor shall cooperate fully with all Quality Assurance.

C. Conformance test requirements and testing frequencies are specified in Paragraph 2.02. The purpose of the conformance testing is to assure that the materials being used from each source conform to the project specifications.

D. Field quality control requirements are specified in Paragraph 3.02 of this document. The purpose of the specified field quality control procedures is to assure that the protective cover soil and leachate collection system has been installed in accordance with the specifications.

1.06 QUALIFICATIONS

A. The work shall be performed by a Contractor that has experience in installation of leachate collection systems and protective cover materials over synthetic liners. The Contractor shall demonstrate proven experience by providing a minimum of one similar completed project with the following information:

1. Types and thicknesses of installed materials.

2. Name and purpose of facility, its location, and date of installation.

3. Name of owner and design engineer. Name and telephone number of contact at the facility who can discuss the project.

B. The suppliers shall show evidence of adequate supplies of each material to be provided within the schedule of construction and evidence that each source area can provide homogenous material and is properly permitted by the appropriate local, State, and Federal agencies.

1.07 DELIVERY, STORAGE, AND HANDLING

A. If materials are delivered to the site prior to placement approval, they shall be stockpiled on site at areas as directed by the Engineer. Provisions shall be implemented to minimize surface water impact on the stockpile. Removal and placement of granular fill material shall be done in a manner to minimize intrusion of soils adjacent to and beneath the stockpile.

PART 2 PRODUCT

2.01 MATERIAL

A. Washed Stone

1. Washed stone to be used for filtration around the leachate and gas collection pipe as shown on the Drawings, shall be sound, hard, durable, resistant to weathering, and free of overburden, spoil, shale, limestone, and organic material. The stone shall conform to NCDOT No. 4. The Contractor shall provide a certification letter in addition to physical and chemical tests results indicating that the stone meets the NCDOT requirements for No. 4 stone. The chemical results shall at a minimum include the results from the "Insoluble Residue in Carbonate Aggregate" test in accordance with ASTM D3042. The weight loss of the aggregate shall be less than five percent.

B. 24-inch Protective Cover and 10-inch secondary sand Drainage Layer

The 24-inch protective cover and the 10-inch secondary sand drainage layer shall not contain stones larger than three inches in diameter and shall have a maximum of 40 percent passing the No. 200 sieve, a maximum liquid limit of 40 percent, and a maximum plasticity index of 10 percent. The protective cover soil shall have a hydraulic conductivity of $5x10^{-5}$ cm/sec or grater (more permeable) when compacted to 90 percent of standard Proctor maximum dry density (ASTM D698).

2.02 CONFORMANCE TESTING

A. Conformance testing shall be conducted by the QCL on the protective cover and the secondary sand drainage layer during their use on the project. The following tests shall be conducted on the protective cover at the indicated frequencies:

Test	Method	Frequency
Grain Size	ASTM D422	Every 4,000 cy
Hydraulic Conductivity	ASTM D2434	Every 6,000 cy
Moisture-Density Relations	ASTM D698	Every 6,000 cy

In addition, QCL shall perform Nuclear Density and Moisture Content (ASTM D6938) on the protective cover and the secondary sand drainage layer at a minimum testing frequency of four tests per acre or as directed by the Engineer in irregular shaped fill areas.

B. Periodic conformance testing shall be conducted by the QCL on the stone materials during their use on the project. The following tests shall be conducted on the stone at the indicated frequencies:

Test	Method	Frequency
Grain Size	ASTM D422	Every 4,000 cy
Insoluble Residue in Carbonate Aggregate	ASTM D3042	Every 4,000 cy

C. Results of the tests specified in Paragraphs 2.02A and B shall be submitted to the Engineer within one week of the test completion. Engineer reserves the right to reject material based on the results of these conformance tests and/or independent quality assurance testing conducted by the QCL. Rejected materials shall be removed from the site at no cost to the Owner.

PART 3 EXECUTION

3.01 SECONDARY SAND DRAINAGE LAYER

A. During placement of the secondary sand drainage layer material, no construction equipment shall be allowed to travel directly on the liner. A minimum 4-foot-thick layer shall be constructed with drainage layer material to support haul trucks delivering material to the cell area.

B. Only low ground pressure (LGP) dozers (10 psi or less track pressure) shall be used for spreading and grading of the secondary sand drainage layer material.

C. Material shall be placed on the side slopes starting at the toe of the slope and working toward the top of the slope.

D. Secondary sand drainage layer material shall only be spread when the liner is laying evenly over liner subgrade. Material shall not be spread over "standing waves" in the liner that form during periods of high temperature and direct sunlight. A standing wave is defined as a ripple in the liner in which the height of the ripple exceeds the width of the ripple. If standing waves are occurring during peak temperature hours, the spreading operation shall be limited to morning and evening hours as directed by the Engineer.

E. No material shall be placed, spread, or compacted while the ground or material is frozen or thawing or during unfavorable weather conditions.

F. The secondary sand drainage layer shall be compacted to a minimum of 90 percent of standard Proctor maximum dry density (ASTM D698) by tracking only.

G. The secondary sand drainage layer surface must be free from ruts to allow for positive drainage at the end of each work day when significant precipitation is forecast and/or at the completion of compaction operations so as to prevent localized saturation of the cover material.

H. Any sample area tested, which does not meet the requirements of the specifications, shall be rejected, removed, and replaced. Reconstructed areas shall have uniform grades matching the grades of adjacent cover material.

3.02 PROTECTIVE COVER LAYER

I. The composite drainage net for the base and final cover liner systems shall be cleaned of all debris, waste material, equipment, and other miscellaneous objects prior to placement of the protective cover material and shall be inspected by the Engineer to check for damage such as tears and defects. The Engineer shall confirm with the installer that all necessary survey information has been obtained. Placement of the protective cover material shall not begin until the Engineer has issued approval of the geomembrane liner and composite drainage net installation. Placement of the protective cover material to the thickness and aerial extent required in the Drawings can then proceed.

J. During placement of the protective cover material, no construction equipment shall be allowed to travel directly on the liner or the composite drainage net. A minimum 4-foot-thick layer shall be constructed with protective cover material to support haul trucks delivering material to the cell area.

K. Only low ground pressure (LGP) dozers (10 psi or less track pressure) shall be used for spreading and grading of the protective cover material.

L. Material shall be placed on the side slopes starting at the toe of the slope and working toward the top of the slope.

M. Protective layer material shall only be spread when the liner is laying evenly over liner subgrade. Material shall not be spread over "standing waves" in the liner that form during periods of high temperature and direct sunlight. A standing wave is defined as a ripple in the liner in which the height of the ripple exceeds the width of the ripple. If standing waves are occurring during peak temperature hours, the spreading operation shall be limited to morning and evening hours as directed by the Engineer.

N. No material shall be placed, spread, or compacted while the ground or material is frozen or thawing or during unfavorable weather conditions.

O. The protective cover shall be compacted to a minimum of 90 percent of standard Proctor maximum dry density (ASTM D698).

P. The protective cover layer surface must be free from ruts to allow for positive drainage at the end of each work day when significant precipitation is forecast and/or at the completion of compaction operations so as to prevent localized saturation of the cover material.

Q. Any sample area tested, which does not meet the requirements of the specifications, shall be rejected, removed, and replaced. Reconstructed areas shall have uniform grades matching the grades of adjacent cover material.

R. The leachate piping shall be installed as specified in the Drawings and backfilled with NCDOT No. 4 stone to the depth and width shown on the Drawings. Care shall be taken during backfilling of the pipe to assure the pipe is not gouged or otherwise damaged.

S. Trenches for the leachate and gas collection pipes shall be excavated through the protective cover material where shown on the Drawings. A non-woven pad shall be placed at the location of each trench prior to protective cover material placement and trench excavation. Excavation of the trench will be performed with a backhoe bucket equipped with a protective sleeve over the bucket teeth or by another method approved by the Engineer. The Contractor shall exercise extreme care not to disturb or damage the composite drainage net or liner. Any liner or drainage net damage shall be immediately repaired as directed by the Engineer.

T. A filter fabric shall be placed along the bottom and sides of the trench with the ends of the fabric anchored into the protective cover material as shown on the Drawings.

U. The leachate and gas piping shall be installed as specified in Section 02623, and shall be backfilled with NCDOT No. 4 stone to the depth and width shown on the Drawings. Care shall be taken during backfilling of the pipe to assure the pipe will not be gouged or otherwise damaged.

V. The NCDOT No. 4 stone shall be mounded over the trench as indicated on the Drawings.

3.02 FIELD QUALITY CONTROL

A. Periodic conformance testing shall be conducted by the Contractor's QCL as specified in Paragraph 2.02.

B. The protective cover thickness shall be confirmed by a topographic survey performed on a 50-foot grid as specified in Section 01050. Areas of insufficient thickness shall be filled to the required depth at no additional cost to the Owner.

END OF SECTION

SECTION 02776

HIGH DENSITY POLYETHYLENE (HDPE) LINER

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment and incidentals required and install 40-mil Textured High Density Polyethylene (HDPE) liner as shown on the Drawings and as specified herein.

1.02 RELATED WORK

Related work includes, but is not limited to, the following:

A. Section 02200: Excavation, Backfill and Compaction.

B. Section 02274: Composite Drainage Net.

C. Section 02700: Drainage Materials.

D. Section 02777: Geoelectric Leak Location Survey.

1.03 SUBMITTALS

A. Within 15 calendar days following the Effective Date of the Agreement, submit the following information in accordance with Section 01300:

1. Submittals relating to liner manufacturer and liner

   a. Corporate Background

   b. Manufacturing capabilities:

      (1) Information on factory size, equipment, personnel, number of shifts per day, and production capacity per shift.
      (2) List of material properties and samples of liner with attached certified test results.
      (3) Manufacturer's quality control program and manual including description of laboratory facilities.
      (4) A list of ten completed facilities totaling a minimum of three million square feet, for which the Manufacturer has manufactured a textured HDPE liner. The following information shall be provided for each facility:

         - Name and purpose of facility, its location, and date of installation.
         - Name of owner, project manager, design engineer, and installer.
         - Liner thickness and surface area.
         - Information on performance of the facility.

c. The origin of the resin to be used in the manufacturing of liner including the supplier's name and production plant, as well as brand name and number. In addition, the Contractor shall include the Certificate of Analysis from the resin supplier.

d. Copy of quality control certificates in conformance with Paragraphs 2.01 and 2.02.

e. Certification that the HDPE liner and extrudate produced for this project have the same properties.

f. A "sample warranty" in accordance with Paragraph 1.08.A.

2. Submittals relating to installing Contractor

a. Background information.

b. Installation capabilities:

(1) Information on equipment (including tensiometer) and personnel.
(2) Anticipated average daily production (complete including QC measures).
(3) A list of minimum values for seam properties.

c. A list of five completed facilities totaling two million square feet for which the installer has installed textured HDPE liner. The following information shall be provided for each facility:

(1) Name and purpose of facility, its location, and date of installation.
(2) Name of Owner, design engineer, manufacturer, and name and telephone number of contact at the facility who can discuss the project.
(3) Thickness of liner and surface area of the installed liner.
(4) Type of seaming, patching, and tacking equipment.
(5) A copy of the manufacturer's certification or approval letter.

d. Shop drawings, including:

(1) Proposed panel layout of HDPE liner, field seams as well as any variance or additional details which deviate from the Drawings.
(2) Details of seaming the liner, anchoring, connections, penetrations, and other construction details.
(3) Proposed installation staging.

e. Installation schedule:

(1) Schedule for installing each acre area.
(2) Schedule for pipe boot installation.

f. A quality control manual that specifically defines the quality assurance program during installation. The manual shall include daily procedures, welding techniques, field testing procedures, lab testing procedures, specific steps that are to be taken in the event of a failure or defect, personnel requirements, levels of authority, and all other information necessary to ensure a high quality liner installation.

g. Resume of the Installation Supervisor to be assigned to the Project.

h. Resume of the Master Seamer to be assigned to the Project.

i. Resume of the Quality Control person to be assigned to the project.

j. A list of personnel performing field seaming operations along with pertinent experience information.

B. Contractor shall submit for approval results of interface shear testing for the subgrade /geomembrane, geomembrane/composite drainage net and composite drainage net/protective cover soil interfaces in accordance with ASTM D5321. The minimum acceptable effective peak interface friction angle for all interfaces is 26.5 degrees. The actual materials to be used on the project shall be used in all tests. Each interface shear strength evaluation shall consist of at least 3 separate shear tests run at normal stresses of 1, 2, and 4 psi.

1.04 REFERENCE STANDARDS

Reference standards include, but are not limited to, the following:

A. American Society for Testing and Materials (ASTM)

1. ASTM D638 - Standard Test Method for Tensile Properties of Plastics

2. ASTM D746 – Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact

3. ASTM D751 – Standard Test Methods for Testing Coated Fabrics

4. ASTM D792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement

5. ASTM D1004 - Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting

6. ASTM D1238 - Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer

7. ASTM D1505 - Standard Test Method for Density of Plastics by the Density-Gradient Technique

8. ASTM D1603 - Standard Test Method for Carbon Black in Olefin Plastics

9. ASTM D3895 - Standard Test Method for Oxidative Induction Time of Polyolefins by Differential Scanning Calorimetry.

10. ASTM D4437 - Standard Practice for Non-destructive Testing (NDT) for Determining the Integrity of Seams Used in Joining Flexible Polymetric Sheet Geomembranes

11. ASTM D4833 – Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products

12. ASTM D5199 – Standard Test Method for Measuring Nominal Thickness of Geosynthetics

13. ASTM D5321 – Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method.

14. ASTM D5397 – Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test

15. ASTM D5596 – Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics

16. ASTM D5994 – Standard Test Method for Measuring Core Thickness of Textured Geomembrane

17. ASTM D6693 – Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes

18. ASTM D7238 - Standard Test Method for Effect of Exposure of Unreinforced Polyolefin Geomembrane Using Fluorescent UV Condensation Apparatus

19. ASTM D7466 - Standard Test Method for Measuring the Asperity Height of Textured Geomembrane

B. Geosynthetic Research Institute (GRI) Standards

1. GRI GM-10: Specifications for the Stress Crack Resistance of Geomembrane Sheet.

2. GRI GM-13: Methods, Properties, and Testing Frequency for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes.

3. GRI GM-19: Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembranes

C. Federal Test Method Standards (FTMS)

1. FTMS 101, Method 2065 - Test Method for Puncture Resistance for Plastics.

D. National Sanitation Foundation (NSF):

2. NSF 54 ANNEX - Modifications to ASTM Standard Test Methods Representing Industries Standard (in accordance with GRI GM 13 for HDPE geomembrane) in joining flexible polymetric sheet geomembranes

E. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY CONTROL

A. In addition to Manufacturer and installer requirements for qualifications and certification specified in Paragraph 1.03, the Quality Control (QC) consists of conformance testing of the material delivered to the site and field QC during installation. The Contractor shall be responsible for Quality Control (QC).

B. Conformance testing requirements are specified in Paragraph 2.03. The purpose of conformance testing is to assure that the supplied material conforms to the specifications and to the Manufacturer's quality control certificates.

C. Field QC requirements are specified in Paragraph 3.06. The purpose of field QC procedures is to assure that the liner has been installed in accordance with the specifications and Manufacturer's recommendations.

D. Quality Control Plan

1. The forms in Appendix A for liner quality control documentation shall be used for field installation documentation. Alternative forms, which provide the same level of detail, may be used for documentation as approved by the Engineer.

E. Geomembrane Quality Control Documentation

1. Pre-installation Conference

a. Prior to commencing work, a pre-installation conference shall be held and the following project personnel shall be identified by name and recorded in the project files:

- Owner's Representative (OR)
- Field Installation Manager (FIM)
- Resident Project Representative (RPR)
- Installation Supervisor (IS)
- Master Seamer (MS)
- Contractor's Representative (CR)
- Quality Control Laboratory (QCL)

b. Two duplicate project files shall be maintained. One shall be maintained by the RPR and the other shall be maintained by the FIM. At the end of each work week, the files shall be updated and checked to ensure that all pertinent project information is included in each file.

c. Blank copies of the following eleven (11) project forms shall be available onsite throughout the duration of the project:

Form No.	Title
100	Liner Project QC Log
101	Receiving QC Log

102	Personnel QC Log
103	Subgrade Surface Acceptance
104	Daily QC Report Pre-Weld Testing
105	Geomembrane Installation Tracking Log
106	Seaming Log
107	Patch Placement Log
108	Destructive Test Log
109	Damage and/or Failure Report
110	Protective Cover Daily Report

F. Record Drawings

1. The Contractor shall furnish AutoCAD record drawings showing changes, if any, from the approved installation drawings which are to include all destructive sample locations, any patches used to repair liner defects, and all panel and patch identifications assigned in the field; and a copy of complete documentation for final installation of the liner.

1.06 QUALIFICATIONS

A. Manufacturer

1. The Manufacturer of the lining material described hereunder shall have previously demonstrated his/her ability to produce this liner by having at least five years continuous experience in the manufacture of HDPE liner and successfully manufactured a minimum of 50 million square feet of similar liner material for hydraulic lining installations.

B. Installer

1. The installer shall be the Manufacturer or an approved installer trained and certified to install the Manufacturer's liner. Installation shall be performed under the constant direction of a single installation supervisor who shall remain on site and be in responsible charge, through the liner installation, for liner layout, seaming, patching, testing, repairs and all other activities required by the installer. The Installation Supervisor shall have installed or supervised the installation and seaming of a minimum of two million square feet of HDPE liner.

1.07 DELIVERY, STORAGE, AND HANDLING

A. The liner rolls shall be packaged and shipped by appropriate means to prevent damage of the liner rolls. Off-loading and storage of the liner is the responsibility of the Contractor. The liner rolls shall be unloaded in the presence of the Engineer or his representative. The Contractor shall be responsible for replacing any damaged or unacceptable material at no cost to the Owner.

B. Damage during off-loading shall be documented by the Engineer or his representative. All damaged rolls must be separated from the undamaged rolls until the proper disposition of that material has been determined by the Engineer.

C. The liner rolls shall be stored so as to be protected from puncture, dirt, grease, water, moisture, mud, mechanical abrasions, and excessive heat that may damage the liner material. The rolls

shall be stored on a prepared surface (not wooden pallets) and shall not be stacked more than two rolls high.

1.08 MATERIAL WARRANTY

A. The HDPE geomembrane liner Manufacturer shall warrant the geomembrane against manufacturing defects and material degradation under outdoor exposure for a period of twenty (20) years on a prorated basis from the date of final payment and acceptance in accordance with the General Conditions. The Manufacturer shall repair or replace, at no additional cost to the Owner, any material which fails from the above causes within the warranty period. The Manufacturer shall furnish a written warranty covering the requirements of this Paragraph.

1.09 GUARANTEE

A. The Contractor shall guarantee the textured HDPE geomembrane liner against defects in installation and workmanship for the period of two years commencing with the date of final acceptance. The guarantee shall include the services of qualified service technicians and all materials required for the repairs at no expense to the Owner.

1.10 DEFINITIONS AND RESPONSIBILITIES

A. Contractor

1. The Contractor is the firm or corporation with whom the Owner has entered into agreement to construct the project. The Contractor is responsible for all submittals by the Manufacturer and the installer as required by the Specifications. The Contractor is responsible for scheduling and coordination of the required work with the Manufacturer and the installer to complete the project. The Contractor is responsible for furnishing as built drawings and a copy of the complete documentation of the liner system. The Contractor is also responsible for daily updating of the design drawings onsite and for any and all deviations from these Drawings. All deviations must be initialed and approved by the RPR onsite.

B. Manufacturer

1. The Manufacturer is the firm or corporation responsible for production of the liner material to be used in the project. The Manufacturer shall produce a consistent product meeting the project specifications, and shall provide quality control documentation for the product specified herein. The Manufacturer is responsible for the condition of the geosynthetic until the material is accepted by the RPR upon delivery and installation. The Manufacturer shall produce a product that consistently meets the project specifications.

C. Installer

1. The Installer is the firm responsible for installation of the liner. The Installer shall be the Manufacturer or an approved Installer trained and certified to install the Manufacturer's geomembrane. The Installer shall be responsible for field handling, storing, placing, seaming, field testing, and all other aspects of the liner installation.

PART 2 PRODUCTS

2.01 MATERIALS

A. General

1. The liner shall be manufactured of new, prime first-quality products designed and manufactured specifically for the purpose of liquid containment in hydraulic structures and chemically resistant to leachate.

2. The liner material shall be so produced as to be free of holes, blisters, undispersed raw materials, or any sign of contamination by foreign matter.

3. The sheets shall be manufactured in a minimum 22 feet seamless width. Labels on the roll shall identify the thickness, length, width, roll number, and Manufacturer's lot number.

4. The textured sheet must not delaminate during tensile testing (i.e., textured layers and "particles" of texture must not separate).

B. Properties

1. The liner rolls shall meet the minimum properties as listed in GRI GM-13.

2. The minimum acceptable effective peak interface friction angle for the subgrade /geomembrane and geomembrane/composite drainage net interfaces is 26.5 degrees when tested in accordance with ASTM D5321.

C. Other Materials

1. Extrudate welding rods shall be of the same compound as the liner and supplied by the manufacturer and shall be delivered in the original sealed containers. Each container shall have a label bearing the brand name, Manufacturer's lot number, and complete directions as to proper storage.

2. Boots and shrouds for pipe penetration shall fit snugly around the pipe. Prefabricated material shall be designed to fit site specific conditions for the intended slope and size of pipe.

2.02 QUALITY CONTROL DOCUMENTATION

A. Prior to installation commencement of any geomembrane liner material, the Contractor shall provide the following information certified by the Manufacturer for the delivered geomembrane liner.

1. Origin, identification, and production of the resin (supplier's name, brand name and production plant).

2. Copies of quality control certificates issued by the resin supplier.

3. Manufacturer's certification verifying that the quality of the resin used to manufacture the liner meets the specified properties.

4. Each roll delivered to the project site shall have the following identification information:

   - Manufacturer's name
   - Product identification
   - Thickness
   - Roll number

5. Quality Control certificates, signed by the Manufacturer's Quality Control manager. Each certificate shall have roll identification number, sampling procedures, frequency, and test results. At a minimum, test results shall be provided for each roll delivered to the site in accordance with test requirements specified in GRI GM-13.

2.03 CONFORMANCE TESTING

A. Conformance testing shall be performed by an independent GRI accredited Quality Control Laboratory (QCL) employed by the Contractor. One sample shall be taken per 100,000 square feet, or one sample per lot, whichever results in the greater number of conformance tests. A lot number will be defined as a continuous production process without changes to raw material or manufacturing methods. This sampling frequency may be increased as deemed necessary by the Engineer. For every change in lot number, the Contractor shall perform conformance testing on the initial roll at the Contractor's expense. The Contractor shall obtain the samples from the roll, at either the manufacturing plant or in the field, and mark the machine direction and identification number. The following conformance tests shall be conducted at the laboratory:

   - Thickness
   - Asperity Height
   - Density
   - Tensile properties
   - Tear resistance
   - Puncture resistance
   - Carbon black content
   - Carbon black dispersion

B. These conformance tests shall be performed in accordance with GRI GM-13.

C. All conformance test results shall be reviewed by the Engineer and accepted or rejected, prior to the placement of the liner. All test results shall meet, or exceed, the property values listed in GRI GM-13 for HDPE geomembrane. In the case of failing test results, the manufacturer may request that the QCL test another sample with the manufacturer's representative present during the testing procedures. The manufacturer shall pay for the retesting. The manufacturer may also have the sample retested at two other QCL facilities approved by the Engineer. If both QCL facilities report passing results, the material shall be accepted. If either laboratory reports failing results, all liner material from the lot representing the failing sample will be considered out of specification and rejected.

PART 3 EXECUTION

3.01 SUBGRADE PREPARATION

A. The HDPE liner subgrade shall be smooth, uniform, and free from sudden changes in grade (such as vehicular ruts), rocks, stones, debris and deleterious materials. During placing and seaming of the HDPE liner, the soil subgrade shall be kept free of all standing water. If the soil subgrade below the liner becomes wet and unstable, it shall be dried and recompacted to the Engineer's satisfaction. If drying and recompacting the material is insufficient, the unstable material must be removed and replaced with approved material.

B. Before the liner installation begins, the Contractor and installer shall verify in writing and submit to the Engineer:

1. Lines and grades are in conformance with the Drawings and Specifications.

2. The surface area to be lined has been rolled and compacted, and is free of irregularities, dry uncompacted soils, and abrupt changes in grade.

3. Engineer and installer must jointly accept the liner subgrade and both sign an approved liner subgrade form documenting approval of the liner subgrade before liner deployment.

C. The Contractor shall not proceed with geomembrane liner installation until the subgrade has been prepared to the satisfaction of the Engineer.

3.02 ANCHOR TRENCH

A. The anchor trench shall be constructed as shown on the Drawings and as specified herein.

B. Slightly rounded corners shall be provided in the trench to avoid sharp bends in the liner.

C. The anchor trench shall be adequately drained to prevent water ponding and softening of adjacent soils. The anchor trench shall be backfilled as shown on the Drawings.

D. If the anchor trench is located in a clay susceptible to desiccation, the amount of trench open at any time shall be limited to one day of liner installation capacity.

3.03 LINER PLACEMENT

A. Weather Conditions

1. Liner placement shall not proceed at an ambient temperature below 32 degrees Fahrenheit or above 104 degrees Fahrenheit unless otherwise authorized, in writing, by the Engineer or his/her field representative. Liner placement shall not be performed during periods of precipitation, excessive moisture, excessive wind, or in areas of ponded water.

B. Method of Placement

1. Each Liner panel shall be placed in accordance with the approved panel layout and approved shop drawings prepared by the Manufacturer. The layout shall be designed to

keep field joining of the textured HDPE liner to a minimum and consistent with proper methods of textured HDPE liner installation.

2. Each liner panel shall be identified by panel number, roll number, and date of deployment. The liner panel number shall be placed on the ends and in the middle of each panel.

3. For liner placed on 4 horizontal to 1 vertical (4H:1V) or steeper slopes, the seams shall be oriented in the direction of the slope. Horizontal seams on 4H:1V slopes or steeper shall not be allowed except for cases in which it is unavoidable. In these instances, a cap strip shall be placed over the seam.

4. The equipment used to deploy the liner shall not cause rutting of the HDPE liner subgrade. If rutting occurs, the Contractor shall suspend all liner placement activities and repair the ruts and immediately employ an alternative method for liner deployment. Liner rolls shall be placed using spreader and rolling bars with cloth slings. If a sheet must be relocated a distance greater than its width, a slip sheet shall be used. If rutting is occurring in the liner subgrade, the Engineer has the option of retesting for compaction.

5. The Engineer's Representative (RPR) shall inspect each panel, after placement and prior to seaming, for damage and/or defects. Defective or damaged panels shall be replaced or repaired, as approved by the Engineer.

6. The Installer shall not drag the liner panels over the liner subgrade.

7. All liner shall be anchored as shown on the Drawings and consistent with Manufacturer's recommendations. Sufficient liner shall be installed within the anchor trench to ensure proper installation prior to backfilling the trench.

8. Personnel working on the liner shall not smoke, wear damaging shoes, or involve themselves in any activity that may damage the liner.

9. The liner shall be properly weighted with sand bags to avoid uplift due to wind.

10. Vehicular traffic across the liner shall not be allowed.

11. All damage shall be recorded and located on the Record Drawings.

12. When tying into existing liner, all exposure of previously installed liner shall be performed by hand to prevent damage.

13. The liner shall be kept free of debris, unnecessary tools, and materials. In general, the liner area shall remain uncluttered in appearance. Any generators in use while on the liner shall have "drop" sheets placed underneath.

14. Fuel shall not be stored on the liner.

15. To prevent a "trampoline effect" from forming, the Contractor shall place sufficient sand bags on the liner along the toe of slopes to ensure full contact of the geomembrane liner with the subgrade surface. In addition, the horizontal seams nearest the toe of slope shall

remain unwelded until all other seams in the area are completed. The final seam shall be welded when the liner is cool and fully contracted. Care shall be taken to ensure that the liner contacts the subgrade in all locations before completing the seam.

16. Contractor shall remove any gas bubbles that may form beneath the liner prior to placing composite drainage net or protective cover. Any cuts made in the geomembrane shall be patched in accordance with the specifications.

D. Liner Boots (Pipe Penetrations)

1. HDPE boots or shrouds shall be furnished and installed where indicated on the Drawings. The boots shall be of the same material as the geomembrane.

2. The geomembrane end of the boots shall terminate in a skirt section suitable for welding to the geomembrane liner. The overlap between the boot and the geomembrane shall be approximately 18 inches. The boot shall be welded to the geomembrane as previously specified herein.

3. Boots and shrouds shall fit snugly around the pipe. Prefabricated material shall be designed to fit site specific condition, for the intended slope and size of pipe.

4. A neoprene rubber gasket shall be used between the boot or shroud and the pipe with a stainless steel clamp. An HDPE sacrificial sheet shall be used between the boot or shroud and the clamp for protection.

5. For pipes larger than 4 inches diameter, a second clamp shall be used. The fastener of the second clamp shall be located on the opposite side of the pipe from the first clamp, to compensate for uneven pressure and elongation.

3.04 FIELD SEAMS

A. Individual panels of liner shall be laid out and overlapped by a minimum of 4 inches prior to welding. The area to be welded shall be cleaned and prepared in accordance with the installer's quality control welding procedures.

B. Double track hot wedge fusion welder shall be used for straight welds.

C. Extrusion welder shall be used for cross seam tees, patches, repairs, penetration boots and detailed work.

D. The welding equipment used shall be capable of continuously monitoring and controlling the temperature, speed, and pressure in the zone of contact where the machine is actually fusing the liner material so as to ensure that changes in environmental conditions will not affect the integrity of the weld.

E. No "fish mouths" will be allowed within the seam area. Where "fish mouths" occur, the material shall be cut, overlapped and a patch fusion weld shall be applied. All welds upon completion of the work shall be tightly bonded. Any liner area showing injury due to excessive scuffing, puncture, or distress from any cause shall be replaced or repaired with an additional piece of liner. The number of patches per 100 feet length shall not exceed five. If more than five patches

per 100 feet length are necessary, then the entire 100 feet length of seam shall be removed. Further welding will cease at this time and the Engineer shall be notified.

F. All seams shall have a seam number that corresponds with the panel layout numbers. The numbering system shall be used in the development of the Record Drawings. Seam numbers shall be derived from the combination of the two panel numbers that are to be welded together.

G. All fusion welded "T" seams (i.e., the result of the liner panels placed perpendicular to each other) shall be double welded where possible. The extrusion process shall be used for the second weld.

H. All extrudate shall be free of dirt, dry, and protected from damage.

I. If an extrusion welder is stopped for longer than one minute, it shall be purged to remove heat-degraded extrudate. All purged extrudate shall be placed on a sacrificial sheet and disposed of properly.

J. In general, seams should be oriented parallel to the line of maximum slope. In corners and odd-shaped geometric locations, the number of seams should be minimized. No horizontal seam should be less than 5 feet from the toe or crest of the slope, or from areas of potential stress concentrations, unless otherwise authorized by the Engineer. Horizontal seams, where required, shall be offset in adjacent panels by at least one panel width and seams shall be "shingled" downhill.

K. All vertical panels placed on sloped surfaces shall extend as shown on the Drawings.

L. All end seams shall be staggered a minimum of 5 feet in length between contiguous panels.

M. To prevent moisture buildup during fusion welding, it may be necessary to place a movable protective layer of plastic directly below each overlap of liner that is to be seamed.

N. If required, a firm substrate shall be provided by using a flat board or similar hard surface directly under the seam overlap to achieve proper support.

O. All seams shall extend to the full extent of the anchor trench.

P. All factory seams, field seams, and repair welds shall meet seam strength requirements specified in GRI GM-19.

3.05 SEAMING WEATHER CONDITIONS

A. Normal Weather Conditions

1. The normal required weather conditions for seaming are:

a. Ambient temperature higher than 32 degrees Fahrenheit and lower than 104 degrees Fahrenheit.

b. No precipitation or other excessive moisture, such as fog or dew.

c. No excessive winds.

2. These weather conditions shall be maintained during the seaming process.

B. Cold Weather Conditions

1. If the ambient temperature is below 32 degrees Fahrenheit, the following conditions shall be met to ensure a quality seaming process:

a. Preheating the surface of the liner to achieve normal temperature range.

b. Preheating may be waived by the RPR if the Installer demonstrates that satisfactory welds of equivalent quality may be obtained without preheating at the expected temperature of installation.

c. Preheating devices shall be approved by the Manufacturer.

d. Care shall be taken to assure that surface temperatures are not lowered below the minimum required surface temperature for welding due to winds.

e. Additional destructive tests shall be taken at the discretion of the Engineer.

f. Test seams, as described in Paragraph 3.06A, shall be performed under the same ambient temperature conditions as the actual seams.

C. Warm Weather Conditions

1. If the ambient temperature is above 104 degrees Fahrenheit, no seaming of liner shall be permitted unless the installer can demonstrate, to the satisfaction of the Engineer that liner seam quality is not adversely impacted.

2. Test seams shall be performed under the same ambient temperature conditions as the actual seams.

3. Additional destructive tests shall be taken at the discretion of the Engineer.

3.06 FIELD QUALITY CONTROL

A. Pre-Weld Testing

1. A test weld 3 feet long from each welding machine shall be run upon the beginning of each shift and every four hours thereafter, under the same conditions as exist for the liner welding. The test weld shall be marked with date, ambient temperature and welder's name, temperature, speed, and welding machine number. A tensiometer shall be required to be on-site before and during liner installation for the purpose of testing samples. Six specimens of welds 1-in wide shall be cut from the test weld and tested on site with the presence of the RPR for shear and peel strength (3 each) in accordance with GRI GM-19. No welder may start work until the sample weld has been approved by the RPR.

2. Test seams shall be performed under the same conditions as the actual seams and shall be at least 3 feet long, 1 foot wide after seaming. Test seam material for welding shall be cut out of the liner rolls.

B. Nondestructive Seam Testing

1. The Installer shall perform nondestructive tests on all field seams over their full length. The purpose of this test is to assure continuity and integrity of the seams. Vacuum and air pressure tests shall be used for nondestructive testing. The vacuum test shall be used for extrusion welds and single track hot wedge welds. The air pressure test shall be used for double track hot wedge welds.

2. Vacuum Testing

a. Equipment for testing single wedge fusion seams and extrusion seams shall be comprised of the following:

(1) A vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft rubber gasket attached to the bottom, port hole or valve assembly and a vacuum gage.

(2) A vacuum tank and pump assembly equipped with a pressure controller and pipe connections.

(3) A rubber pressure/vacuum hose with fittings and connections.

(4) A plastic bucket and wide paint brush.

(5) A soapy solution.

b. The following procedures shall be followed by the installer:

(1) Excess sheet overlap shall be trimmed away.

(2) Clean the window, gasket surfaces and check for leaks.

(3) Energize the vacuum pump and apply a vacuum of approximately 5 psi (gage).

(4) Wet a strip of liner approximately 12 inches by 48 inches (length of box) with the soapy solution.

(5) Place the box over the wetted area and compress.

(6) Close the bleed valve and open the vacuum valve.

(7) Ensure that a leak-tight seal is created.

(8) For a minimum period of ten seconds, examine the liner through the viewing window for the presence of soap bubbles.

(9) If no bubbles appear after ten seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum of 3 inches overlap and repeat the process.

10) All areas where soap bubbles appear shall be marked and repaired in accordance with Paragraph 3.07.F and then retested.

11) All test locations which have passed vacuum testing shall be marked with the test date and individual performing the test.

c. If the seam cannot be tested prior to final installation, the seaming operations shall be observed by the RPR for uniformity and completeness.

3. Air Pressure Testing

a. The following procedures are applicable to those processes which produce a double seam with an enclosed space.

b. Equipment for testing double fusion seams shall be comprised of the following:

(1) An air pump equipped with pressure gage capable of generating and sustaining a pressure between 25 and 30 psi (gage) and mounted on a cushion to protect the liner.

(2) A manometer equipped with a sharp hollow needle, or other approved pressure feed device.

c. The following procedures shall be followed by the Installer.

(1) Seal both ends of the seam to be tested.

(2) Insert needle or other approved pressure feed device into the air channel created by the double wedge fusion weld.

(3) Energize the air pump to a pressure of 30 psi (gage), close valve and sustain pressure for at least five minutes.

(4) If loss of pressure exceeds 3 psi (gage), or pressure does not stabilize, locate faulty area, repair in accordance with Paragraph 3.07F and retest in accordance with Paragraph 3.07G.

(5) If the faulty area cannot be isolated and repaired, the length of seam which cannot be tested shall be capped with liner strip, extrusion welded and vacuum tested. The seam shall be documented as a failed seam indicating the corrective measure.

(6) If loss of pressure is 3 psi (gage) or less, release air pressure at the opposite end of where the pressure is applied to verify that the full seam was pressurized and that there was no blockage in the air channel.

(7) Remove needle or other approved pressure feed device and seal.

(8) All test locations which have passed air pressure testing shall be marked with the test date and individual performing the test.

d. Destructive seam testing shall be performed in accordance with Paragraph 3.07.

3.07 DESTRUCTIVE SEAM TESTING

A. The purpose of the destructive testing is to evaluate seam strength properties. A minimum of one test sample shall be obtained per 500 feet of performed seam length or one sample per crew per day whichever yields the largest number of samples. The location of samples shall be determined by the RPR. Selection of such locations may be prompted by suspicion of overheating, contamination, or other potential cause that may adversely impact the welds. Sampling shall be performed by the installer. The Contractor shall forward the samples to the QCL for testing and shall pay for the testing.

B. Sampling Procedures

1. Samples shall be cut by the Installer at locations chosen by the RPR as the seaming progresses.

2. The seams shall not be covered by another material before the test samples have been tested by the QCL and accepted by RPR.

3. Upon obtaining each sample, assign a number to the sample and mark it accordingly.

4. Record sample location on layout drawing.

5. Record purpose of the sample, statistical routine or suspicious weld area.

6. Holes in the liner resulting from destructive seam testing shall be immediately repaired in accordance with Paragraph 3.07.F and tested in accordance with Paragraph 3.07.G.

C. Size and Disposition of Samples

1. The sample for laboratory testing shall be 12 inches wide by 36 inches long with the seam centered lengthwise. The sample shall be cut into three parts and distributed as follows:

a. One portion to the Installer for field testing, 12 inches by 12 inches.

b. One portion for Quality Assurance Laboratory testing, 12 inches by 12 inches.

c. One portion to the Engineer for archive storage, 12 inches by 12 inches.

D. Quality Control Laboratory Test

1. The Contractor shall package and ship destructive test samples to the independent GRI accredited Quality Control Laboratory (QCL) employed by the Contractor.

2. Laboratory test shall include shear and peel strength tests. The minimum acceptable values obtained in these tests shall be in accordance with GRI GM-19.

3. The laboratory shall cut the sample to one inch wide coupons using a die or other means. At least ten (10) coupons shall be cut for peel and shear test.

4. Five coupons shall be tested each for shear and the other five shall be tested for peel strength. A passing test shall meet the minimum required values for four of the five coupons tested for each method.

5. The QCL shall provide verbal test results to the Engineer no more than 48 hours after they receive the samples. The Engineer shall review the laboratory results as soon as they become available.

E. Procedures for Destructive Test Failure

1. The following procedures shall apply whenever a sample fails a destructive test. The Installer has two options:

   a. The Installer can repair the seam between any two passing test locations; or

   b. Two new samples can be taken at a minimum of 10 feet on each side of the original failed sample. These samples shall be sent to the Quality Assurance Laboratory for testing. Subsequent failure of test samples shall cause the testing to move further down the seam until the extent of the faulty seam has been determined.

   c. In the event the whole seam is determined to be faulty. The Engineer may request samples to be taken from the previous seam welded by the same machine and welder, until two passing tests are obtained.

2. All acceptable repaired seams shall be bound by two passing locations. In cases where repaired seam exceeds 150 feet, a sample taken from the zone in which the seam has been repaired must pass destructive testing. Repairs shall be made in accordance with Paragraph 3.07.F and tested in accordance with Paragraph 3.07.G.

3. The RPR shall document all actions taken in conjunction with destructive test failures.

F. Repair Procedures

1. Any portion of the liner exhibiting signs of defect or failing a destructive or a nondestructive test, or exhibiting the buildup of landfill gas beneath it, shall be repaired. Several procedures exist for the repair of these areas. The final decision as to the appropriate repair procedure shall be made by the Engineer.

2. The repair procedures available include:

a. Patching, used to repair large holes, tears, undispersed raw materials, and contamination by foreign matter.

b. Spot welding or seaming, used to repair small tears, pinholes, or other minor, localized defects.

c. Capping, used to repair large lengths of failed seams.

d. Removing bad seam and replacing with a strip of new material welded in place.

e. For small lengths of failed seam (less than 3 feet), extrusion welding can be used to repair provided there is sufficient overlap between the two liner panels.

f. Extrusion welding the flap of a fusion welded seam is not an acceptable repair procedure.

3. For any repair method, the following provisions shall be satisfied:

a. Surfaces of the liner which are to be repaired using extrusion methods shall be abraded no more than one hour prior to the repair.

b. All surfaces shall be clean and dry at the time of the repair.

G. Repair Verification

1. Each repair shall be numbered and logged by the Installer. Each repair shall be nondestructively tested using the methods described in Paragraph 3.06 as appropriate. Repairs which pass the nondestructive test shall be taken as an indication of an adequate repair. Repairs more than 150 feet long may be of sufficient length to require destructive test sampling, at the discretion of the Engineer. In the event of additional failing tests, the repair shall be redone and retested until passing test results are achieved. The Engineer shall observe all nondestructive testing of repairs. The Installer shall record the number of each repair, date and test outcome.

H. Wrinkles

1. Large wrinkles that remain in the sheet as result of temperature expansion or uneven surface preparation may need removal as determined by the RPR in consideration of applied loads on the wrinkle. Should the wrinkle need removing, the lower down-slope edge of the wrinkle shall be cut, overlapped and repaired as described in Paragraph 3.07.G. Both ends of the wrinkle repair shall be patched. Caution must be taken in removing any wrinkles. Wrinkles are needed to allow for future contraction of the geomembrane liner, especially in cold weather.

I. Construction Equipment

1. Construction equipment or vehicles with steel tracks shall not be permitted on the geomembrane. Other equipment such as portable generators and power centers shall be permitted if the support apparatus is protected from damaging the liner, and if care is taken to prevent leaking lubricants from damaging the geomembrane.

3.08 DISPOSAL OF WASTE MATERIAL

A. Upon completion of installation, the Contractor shall dispose of all trash, waste material, and equipment used in connection with the performed Work and shall leave the premises in a neat and acceptable condition.

3.09 RELIEF OF GAS PRESSURE BENEATH LINER

A. Prior to the placement of overlying final cover components, Contractor shall relieve any landfill gas visibly trapped beneath the liner by piercing the liner to allow the gas to escape and subsequently patching the hole as required in Paragraph 3.07.

3.10 GEOELECTRIC LEAK LOCATION SURVEY (See Section 02777)

3.11 AS-BUILT DRAWINGS

A. The Installer shall prepare and submit to the Engineer an as-built drawing reflecting the actual installation of geomembrane liner, including the location of all seams, the location of destructive samples, and the location of all repair work. The as-built drawing shall be submitted to the Engineer within 14 days of job completion. In addition, a copy of the complete documentation package will accompany the as-built drawing.

END OF SECTION

APPENDIX A

GEOMEMBRANE QUALITY CONTROL DOCUMENTATION FORMS

The following forms are included and shall be completed by the responsible party as shown on the forms.

Form No.	Title
CQC - 100	Liner Project QC Log
CQC - 101	Receiving QC Log
CQC - 102	Personnel QC Log
CQC - 103	Subgrade Surface Acceptance
CQC - 104	Daily QC Report Pre-weld Testing
CQC - 105	HDPE Liner Installation Tracking Log
CQC - 106	Seaming Log
CQC - 107	Patch Placement Log
CQC - 108	Destructive Test Log
CQC - 109	Damage and/or Failure Report
CQC - 110	Protective Cover Daily Report

FORM CQC - 100
LINER PROJECT QC LOG
(one sheet per project)

PROJECT

NAME: _____

NUMBER: _____

LOCATION: _____

OWNER: _____

ADDRESS: _____

CONTACT: _____ PHONE: _____

EngineerING

ENGINEERING FIRM: _____

ADDRESS: _____

CONTACT: _____ PHONE: _____

Contractor

GENERAL Contractor: _____

ADDRESS: _____

CONTACT: _____ PHONE: _____

SUPPLIER OF LINER MATERIALS

NAME: _____

ADDRESS: _____

CONTACT: _____ PHONE: _____

FORM CQC - 100
LINER PROJECT QC LOG
(one sheet per project)
(Continued)

QC INSPECTION

NAME: _____

ADDRESS: _____

CONTACT: _____ PHONE: _____

TESTING LABORATORY

LINER TESTING LABORATORY: _____

ADDRESS: _____

CONTACT: _____ PHONE: _____

FABRICATOR OF MATERIAL

NAME: _____

ADDRESS: _____

CONTACT: _____

INSTALLER OF MATERIAL

NAME: _____

ADDRESS: _____

CONTACT: _____

LINER MATERIALS

SPECIFIED LINER MATERIALS: _____ THICKNESS & TYPE: _____

MATERIAL CERTIFICATION

MATERIAL CERTIFICATION RECEIVED: _____

DATE: _____ ACCEPTED: _____

FORM CQC - 101
RECEIVING QC LOG
(one sheet per truck)

PROJECT NAME: _____

DATE: _____ TIME: _____ PROJECT NUMBER: _____

TRUCKERS ID: _____

NO. OF PIECES ON BOARD: _____ AGREE WITH PACKING LIST? _____

CONDITION OF PACKAGING: _____

VERIFY PROPER MATERIALS: _____ VERIFY PROPER THICKNESS: _____

IDENTIFY ROLL NUMBERS: _____

_____

IDENTIFY ACCESSORIES (*adhesive, battens, boots, etc.)*: _____

_____

IDENTIFY DAMAGED ITEMS: _____

_____

TYPE OF UNLOADING EQUIPMENT USED: _____

OPERATOR: _____

COMMENTS: _____

_____

STORAGE AREA

CONDITION *(surface)*: _____

LOCATION TO PLACEMENT AREA: _____

MATERIAL PROPERLY COVERED: _____

WEATHER

CONDITIONS: _____ TEMP: _____

SIGNATURES

QC INSPECTOR: _____

SITE SUPERVISOR: _____

Use back for other comments

FORM CQC - 102
PERSONNEL QC LOG
(installation & field seaming personnel)
(complete for each mobilization or change of personnel)

PROJECT NAME: _____

DATE: _____ PROJECT NUMBER: _____

SAFETY MEETING CONDUCTED ON MATERIALS HANDLING: _____

GIVEN BY: _____ DATE: _____

SUPERINTENDENT OF INSTALLATION: _____

SEAMING CREW PERSONNEL

#1 CREW LEADER: _____ HELPER: _____

#2 CREW LEADER: _____ HELPER: _____

#3 CREW LEADER: _____ HELPER: _____

#4 CREW LEADER: _____ HELPER: _____

#5 CREW LEADER: _____ HELPER: _____

#6 CREW LEADER: _____ HELPER: _____

#7 CREW LEADER: _____ HELPER: _____

#8 CREW LEADER: _____ HELPER: _____

OTHER CREW MEMBERS

NAME: _____ NAME: _____

NAME: _____ NAME: _____

NAME: _____ NAME: _____

SIGNED: _____

QC Inspector

FORM CQC - 103
SUBGRADE SURFACE ACCEPTANCE
(once sheet per Day of Liner Deployment)

1. Surface for liner placement accepted, covered by panel numbers: _____

_____

_____

Approximate size of area: _____

CERTIFICATE OF ACCEPTANCE
OF SUBGRADE SOIL BY INSTALLER

I the undersigned, duly authorized representative of _____ do hereby accept the soil surface as being acceptable for the placement of a geomembrane liner.

_____	_____	_____	_____
Name	Signature	Title	Date

Certificate Accepted by Inspector - Company: _____

_____	_____	_____	_____
Name	Signature	Title	Date

QC INSPECTOR: _____

SITE SUPERVISOR: _____

INSTALLING SUPERVISOR: _____

COMMENTS

_____

_____

_____

_____

_____

FORM CQC - 104
DAILY QC REPORT
PRE-WELD TESTING

DATE: _____ JOB NAME: _____ JOB NO.: _____ MATERIAL: _____

TIME	AMBIENT TEMP.	WEATHER	WIND	TECH.	MACHINE			DESTRUCTIVE TEST						PASS FAIL	EFR INITIALS
					ID NO.	TEMP.	SPEED	PEEL			SHEAR				

FORM CQC - 105
HDPE LINER INSTALLATION TRACKING LOG

DATE	PANEL NO.	CELL NO.	ROLL NO.	LENGTH	WIDTH	SQUARE FT.

FORM CQC - 106
SEAMING LOG
(one sheet per day)

DATE: _____ JOB NAME: _____ JOB NO.: _____ MATERIAL: _____

AMBIENT TEMP.: AM PM WIND: AM PM WEATHER: AM PM

	LOCATION		INSTALLATION				WEDGE WELD		EXTRUSION WELD		
TIME	SEAM NO.	LENGTH	TECH.	MACH ID. NO.	MACH. TEMP.	SPEED	START PSI	FINISH PSI	VAC. TEST Y/N	PASS/ FAIL	COMMENTS

COMMENTS: _____

_____

DAILY TOTALS: Liner_____ sq. ft., Length Seamed _____ ft., No. Destructs marked _____ Anchor Trench: Dug _____ Accepted _

FORM CQC - 107
PATCH PLACEMENT LOG
(one sheet per day)

DATE: _____ JOB NAME: _____ JOB NO.: _____ MATERIAL: _____

AMBIENT TEMP.: AM PM WIND: AM PM WEATHER: AM PM

			INSTALLATION			EXTRUSION WELD		
TIME	PATCH NO.	DESCRIPTION LOCATION	TECH.	MACH ID. NO.	MACH. TEMP.	VAC. TEST Y/N	PASS/ FAIL	COMMENTS

COMMENTS: _____

_____

DAILY TOTALS: Liner_____ sq. ft., Length Seamed _____ ft., No. Destructs marked _____

FORM CQC - 108
DESTRUCTIVE TEST LOG

JOB NAME: _____ JOB NO.: _____ MATERIAL: _____

DATE CUT	SAMPLE I.D.	SEAM NO.	MACH. ID NO.	SEAMER INITIALS	PEEL TEST LBS./INCH			SHEAR TEST LBS./INCH			PASS/ FAIL	DATE TO LAB PKG. SLIP NO.	LAB PASS/FAIL	LOCATION/ COMMENT

FORM CQC - 109
DAMAGE AND/OR FAILURE REPORT

JOB NAME: _____ JOB NO.: _____ PAGE: _____

DATE	PANEL NO.	SEAM NO.	LOCATION OF DAMAGE	TYPE OF DAMAGE OR FAILURE	TYPE OF REPAIR	NEW SEAM NO.	NEW PATCH NO.

COMMENTS: _____

_____

_____

FORM CQC - 110
PROTECTIVE COVER
DAILY REPORT

DATE: _____ JOB NAME: _____ JOB NUMBER: _____

PANEL NO.	CELL NO.	SQUARE FEET INSTALLED	HAULING EQUIPMENT	SPREADING EQUIPMENT	COMMENTS

SECTION 02777

GEOELECTRIC LEAK LOCATION SURVEY

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall provide and pay for geoelectric leak location surveying, performed by a qualified, independent testing firm, such as Leak Location Services, Inc. to ensure no puncturing of the HDPE geomembrane liner occurred during the installation. Approval of a firm other than Leak Location Services, Inc. will be solely at the discretion of the Engineer and the Owner. The leak location survey will be conducted on the primary and secondary HDPE geomembrane liner of Phase 1L. All leaks located by the survey shall be repaired at no additional cost to the Owner. Following completion of all repairs, at no additional cost to the Owner, the repairs will be verified by vacuum tests. This process will be performed until all repairs have been deemed acceptable by the Engineer. The Contractor shall submit a plan prior to performing the work that describes the methods to be employed and demonstrates equivalency to the requirements specified herein. The results of the leak location survey shall be communicated to the RPR before the leak location survey crew leaves the site. A report documenting the electrical leak location surveys shall be submitted within 14 days of the completion of each leak survey. The reports shall document the methodology used, the locations and descriptions of the leaks, and a diagram of the facility showing the approximate leak locations. If the Owner decides to construct the landfill cell in two separate phases as shown on the Drawings, the Contractor shall schedule the leak location survey in Subcell A such that the survey report is available to the Engineer no later than the Subcell A Substantial Completion date.

B. Requirements for performance of the HDPE geomembrane liner leak location survey using electrical methods for post-installation of the primary and secondary HDPE geomembrane liner with the primary HDPE geomembrane liner covered with a composite drainage net and a 24-inch protective cover layer and a secondary geomembrane covered by a 10-inch sand layer .

C. Leak location survey shall be conducted after the sand layer is installed over the primary and the secondary geomembrane and before the scrim reinforced tarp is installed. Leak location survey shall be performed to detect leaks in the primary and secondary HDPE geomembrane liner resulting from damage caused during placement of the sand layer.

D. The optimum performance of a geoelectric leak location survey using electrical methods requires the conductive media above and below the HDPE geomembrane liner to be electrically isolated so that leaks can be located in the HDPE geomembrane liner.

E. Contractor shall be aware of the leak detection activities outlined herein and shall account for these activities in the construction schedule.

1.02 RELATED WORK

A. Section 02230: Drainage Materials.

B. Section 02776: High Density Polyethylene (HDPE) Liner.

1.03 SUBMITTALS

A. Contractor shall submit a Leak Location Survey Work Plan to Engineer for approval 30 days prior to commencement of the leak location survey in accordance with Section 01300. The Leak Location Survey Work Plan shall include:

1. Qualifications of the proposed Leak Location Contractor to include the number of years Leak Location Contractor has performed the proposed survey method

2. Resumes of proposed on-site supervisors

3. Required site preparations

4. Estimated duration of survey

5. Quality control and field calibration procedures

6. A list of projects demonstrating the qualifications and experience where the proposed Leak Location Contractor and leak location supervisor have met the requirements of Paragraph 1.05 of this specification

7. Sample of a final report (per ASTM D7002 and ASTM D7007) provided by the Leak Location Contractor

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM D7007 – Standard Practices for Electrical Methods for Locating Leaks in Geomembranes Covered with Water or Earth Materials.

1.05 QUALIFICATIONS

A. Leak location subcontractor shall have qualifications and experience in conducting geoelectrical leak location survey for double geomembrane liner systems including having tested a minimum of 15,000,000 square feet of HDPE geomembrane liner within the previous three years. In addition, the leak location surveys must be supervised by a professional or technician with a minimum of three years and 3,000,000 square feet of HDPE geomembrane liner testing experience using the specified leak location survey method. The leak location supervisor must be on site full-time during the performance of the leak location survey.

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION

3.01 SITE PREPARATION

A. Leak location subcontractor will identify actions required by Contractor to prepare the site for the leak location survey, including means to make electrical contact with the conductive material under the HDPE geomembrane liner. Specifically, a bare copper wire shall be installed between the two layers of geomembrane along the center of the length of the

double liner area. The bare copper wires shall be 10AWG or heavier. The wires shall be spaced to be within 200 feet of every point under the HDPE geomembrane liner and shall exit from between the HDPE geomembrane liner at opposite edges of the cell. Twenty-five feet of insulated 16 AWG or heavier copper wire shall be attached to the bare copper wire before the bare copper wire exits from between the HDPE geomembrane liners. The ends of the wire will have to temporarily protrude from between the geomembranes before the areas can be patched. The Contractor shall provide a survey of these points with the as-built drawings at the end of the project.

B. The leak detection wires shall be located and protected during construction and leak survey for future use if needed.

C. Contractor shall ensure that the sand drainage layer above the primary and the secondary geomembrane contains sufficient moisture to conduct a leak location survey. In particular, the primary HDPE geomembrane liner must be wet, either from a rainfall, from excess moisture in the sand, or by wetting the primary liner with the equivalent of 0.1 inch of water (2,700 gallons/acre) immediately prior to installing the sand on the primary geomembrane. Adequate moisture in the sand is indicated when the material appears to be darker than the dry surface material. If the surface of the sand layer is dry, water must be sprayed on the sand layer immediately prior to the leak location survey. The Contractor shall be responsible for providing the additional water.

E. Contractor shall provide electrical isolation between the material above and below the primary HDPE geomembrane liner by ensuring that a minimum of 1-ft of primary HDPE geomembrane liner and geocomposite is continuously exposed around the edge of the landfill cell near the liner anchor trench per Paragraph 3.02. Any conducting penetrations through the primary HDPE geomembrane liner such as metal pipes or concrete structures should also be isolated using complete insulating coatings.

3.02 EXECUTION

A. Leak location subcontractor shall inspect the site prior to commencing each of the surveys to ensure all site preparations are completed and the site conditions are appropriate for conducting the appropriate leak location survey.

B. Any discrepancy in the required site preparation described above or in the Leak Location Survey Work Plan shall be reported to the Contractor for corrective or appropriate action.

C. After the 10-inch sand layer is placed on the secondary HDPE geomembrane liner and before the primary geomembrane liner is installed, conduct a leak location survey on the sand layer using the practices for surveys with earth materials covering geomembranes in accordance with ASTM D7007. Use a 9.5-mm diameter (0.375-inch diameter) actual or artificial leak for calibration.

D. After the 24-inch protective cover layer is placed on the primary HDPE geomembrane liner and before the scrim-reinforced tarp is installed, conduct a leak location survey on the sand layer using the practices for surveys with earth materials covering geomembranes in accordance with ASTM D7007. Use a 9.5-mm diameter (0.375-inch diameter) actual or artificial leak for calibration.

E. Leak location subcontractor shall inform the Engineer and mark the locations of all identified or

indicated leaks with flags, spray paint, or written coordinates.

F. In addition, any leaks that are found must be excavated by Contractor and isolated from the materials covering the geomembrane. Then additional leak location measurements shall be made on the two closest leak location survey lines to determine if additional leaks are in the vicinity. If an additional leak is found, this process shall be repeated. All repairs shall be paid for by the Contractor.

3.03 REPORTING

A. If the Owner decides to construct the landfill cell in two separate phases as shown on the Drawings, the Contractor shall schedule the leak location survey in Subcell A such that the survey report is available to the Engineer no later than the Subcell A Substantial Completion date.

B. Submit to the Engineer, for review and approval, 3 copies of the written report within 14 calendar days of completion of the leak location survey field work or the Subcell A Substantial Completion whichever comes first.

END OF SECTION

SECTION 02901

MISCELLANEOUS WORK AND CLEANUP

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required to do the miscellaneous work not specified in other sections but obviously necessary for the proper completion of the work as shown on the Drawings.

B. When applicable, the Contractor shall perform the work in accordance with other sections of these Specifications. When no applicable specification exists the Contractor shall perform the work in accordance with the best modern practice and/or as directed by the Engineer.

C. The work of this Section includes, but is not limited to, the following:

1. Construction and maintenance of temporary access roads and any necessary drainage, erosion, or sedimentation control structures or measures.

2. Crossing and locating existing utilities.

3. Restoring existing roadways and pavements.

4. Cleanup.

5. Incidental work.

6. Job photographs and video, as applicable. (Pre-construction & Progress photographs)

7. Traffic control.

8. Protection and/or removal and reinstallation of signs, lampposts, and incidental structures.

9. Protection and bracing of utility poles.

10. Restoring easements and right-of-ways.

11. Temporary facilities.

12. Construction Schedules.

14. Record Documents (Shop Drawings, Specifications, Warranties, and Record Drawings).

PART 2 PRODUCTS

2.01 MATERIALS

A. Materials required for this Section shall be the same quality of materials that are to be restored. Where possible, the Contractor may re-use existing materials that are removed as directed by the Owner and Engineer.

PART 3 EXECUTION

3.01 CROSSING AND RELOCATING EXISTING UTILITIES

A. This Item includes work required in crossing culverts, water courses, including brooks and drainage ditches, storm drains, gas mains, water mains, electric, telephone, gas and water services and other utilities. This work shall include but is not limited to the following: bracing, hand excavation and backfill (except screened gravel) and any other work required for crossing the utility or obstruction not included for payment in other items of this specification.

B. In locations where existing utilities cannot be crossed without interfering with the construction of the work as shown on the Drawings, the Contractor shall remove and relocate the utility as directed by the Engineer or cooperate with the Utility Companies concerned if they relocate their own utility.

C. At pipe crossings and where designated by the Engineer, the Contractor shall furnish and place screened gravel bedding so that the existing utility or pipe is firmly supported for its entire exposed length. The bedding shall extend to the mid-diameter of the pipe crossed.

3.02 RESTORING OF ROADWAYS

A. Existing roadways disturbed by the construction shall be replaced. Paved drives shall be repaved to the limits and thicknesses existing prior to construction. Gravel drives shall be replaced and regraded.

3.03 CLEANING UP

A. The Contractor shall remove all construction material, excess excavation, buildings, equipment and other debris remaining on the job as a result of construction operations and shall restore the site of the work to a neat and orderly condition.

3.04 INCIDENTAL WORK

A. Do all incidental work not otherwise specified, but obviously necessary to the proper completion of the Contract as specified and as shown on the Drawings.

3.05 TEMPORARY FACILITIES

A. The Contractor shall furnish, install, maintain and remove all temporary facilities required for construction or called for in the specifications.

END OF SECTION

SECTION 02985

SEEDING AND MULCHING

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment, and incidentals necessary to finish grade, seed, and maintain all seeded areas as indicated on the Drawings and specified herein including all areas disturbed by the Contractor's operations.

1.02 SUBMITTALS

A. In accordance with Specification Section 01300, submit to the Engineer for review complete shop drawings for all materials and equipment furnished under this Section, including seed mixtures and product label information.

B. Samples of all materials shall be submitted for inspection and acceptance upon Engineer's request.

C. The Contractor shall submit certified surveys in accordance with Sections 01025 and 01050 documenting the payment limits for both temporary and permanent seeding. Full payment will be made upon establishing a 100 percent stand of grass in all disturbed areas.

PART 2: PRODUCTS

2.01 MATERIALS

A. Fertilizer shall be complete commercial fertilizer per the requirements of the approved Erosion and Sedimentation Control Plan. It shall be delivered to the site in the original unopened containers each showing the manufacturer's guaranteed analysis. Store fertilizer so that when used it shall be dry and free flowing.

B. Lime shall be ground limestone containing not less than 85 percent calcium and magnesium carbonates. Liquid lime will not be an acceptable substitute for agricultural lime.

C. Seed shall be from the same or previous year's crop; each variety of seed shall have a percentage of germination not less than 90, a percentage of purity not less than 85, and shall not contain more than 1% weed content. Seed supplier shall be NCDOT certified.

D. The seed shall be furnished and delivered premixed in the proportions specified on the approved Erosion and Sedimentation Control Plan. A manufacturer's certificate of compliance to the specified mixes shall be submitted by the manufacturer for each seed type. These certificates shall include the guaranteed percentages of purity, weed content and germination of the seed, and also the net weight and date of shipment. No seed may be sown until the Contractor has submitted the certificates.

E. Seed shall be delivered in sealed containers bearing the dealer's guaranteed analysis.

F. Erosion control blanket to be placed over seeded areas as shown on the Drawings shall consist of wood excelsior with 80% 6-inch fibers or greater fiber length with the top of the blanket covered with photo-degradable or biodegradable netting. Blanket shall be of consistent thickness with fibers evenly distributed throughout the entire area of the blanket. Blanket shall be recommended by manufacturer for use on slopes up to 1.5:1, stormwater channel velocities up to 5 fps, and flow shear stresses up to 2 lbs/sf. Install blanket in accordance with manufacturer's recommendations.

PART 3: EXECUTION

3.01 APPLICATION

A. DEFINITION:

Temporary Seeding: Planting rapid-growing annual grasses, small grains, or legumes to provide initial, temporary cover for erosion control on disturbed areas.

Permanent Seeding: Controlling runoff and erosion on disturbed areas by establishing perennial vegetative cover with seed.

B. PURPOSE:

Temporary Seeding: To temporarily stabilize denuded areas that will not be brought to final grade for a period of more than 15 working days. Temporary seeding controls runoff and erosion until permanent vegetation can be established.

Permanent Seeding: To reduce erosion and decrease sediment yield from disturbed areas, and to permanently stabilize such areas in a manner that is economical, adapts to site conditions, and allows selection of the most appropriate plant materials.

C. CONDITIONS WHERE PRACTICE APPLIES:

Temporary seeding: On any cleared, unvegetated, or sparsely vegetated soil surface where vegetation cover is needed for less than 1 year. Applications of this practice include diversion berms, dams, temporary sediment basins, temporary road banks, and topsoil stockpiles.

Permanent seeding: Fine-graded areas on which permanent, long-lived vegetative cover is the most practical or most effective method of stabilizing the soil. Permanent seeding may also be used on rough-graded areas that will not be brought to final grade for a year or more.

Any areas to be stabilized with permanent vegetation must be seeded or planted within 15 working days or 90 calendar days after final grade is reached, unless temporary stabilization is applied.

D. SEEDBED REQUIREMENTS:

Establishment of vegetation should not be attempted on sites that are unsuitable due to inappropriate soil texture, poor drainage, concentrated overland flow, or steepness of slope until measures have been taken to correct these conditions.

To maintain a good stand of vegetation, the soil must meet certain minimum requirements as a growth medium. The existing soil should have the following criteria:

1. Enough fine-grained (silt and clay) material to maintain adequate moisture and nutrient supply (available water capacity of at least .05 inches water to 1 inch of soil.

2. Sufficient pore space to permit root penetration.

3. Sufficient depth of soil to provide an adequate root zone. The depth to rock or impermeable layers such as hardpans should be 12 inches or more, except on slopes steeper than 2:1 where the addition of soil is not feasible.

4. A favorable ph range for plant growth, usually 6.0 to 6.5.

5. Free from large roots, branches, stones, large clods of earth, or trash of any kind.

If any of the above criteria are not met (i.e., if existing soil is too coarse, dense, shallow or acidic to foster vegetation), special amendments will be required. The soil conditioners described below may be beneficial or, preferably, topsoil may be applied.

E. SEEDBED PREPARATION:

Install necessary mechanical erosion and sedimentation control practices before seeding, and complete grading according to the approved plan. Lime and fertilizer needs should be determined by soil tests. Soil testing is performed free of charge by the North Carolina Department of Agriculture Soil Testing Laboratory.

When soil tests are not available, follow rates suggested in Paragraphs I and J.

Apply lime and fertilizer evenly and incorporate into the top 4 to 6 inches of soil by disking or other suitable means. Operate machinery on the contour. Scarify surfaces prior to seeding.

Complete seedbed preparation by breaking up large clods and raking into a smooth, uniform surface (slopes less than 3:1). Fill in or level depressions that can collect water. Broadcast seed into a freshly loosened seedbed that has not been sealed by rainfall.

F. SEEDING:

Seeding dates given in the seeding mixture specifications are designated as "best" or "possible". Seedlings properly carried out within the "best" dates have a high probability of success. It is also possible to have satisfactory establishment when seeding outside these dates. However, as you deviate from them, the probability of failure increases rapidly. Seeding on the last date shown under "possible" may reduce changes of success by 30 to 50 percent. Always take this into account in scheduling land-disturbing activities.

Use certified seed for permanent seeding. Certified seed is inspected by the North Carolina crop improvement association. It meets published North Carolina standards and should bear an official "certified seed" label.

Labeling of non-certified seed is also required by law. Labels contain important information on seed purity, germination, and presence of wood seeds. Seeds must meet state standards for content of noxious weeds. Do not accept seed containing "prohibited" noxious weed seed.

Inoculate legume seed with the Rhizobium bacteria appropriate to the species of legume.

Apply seed uniformly with a cyclone seeder, drop-type spreader, drill, or cultipacker seeder on á firm, friable seedbed.

When using a drill or cultipacker seeder, plant small grains no more than 1 inch deep, with grasses and legumes no more than 1/2 inch deep. Equipment shall be calibrated in the field for the desired seeding rate.

When using broadcast-seeding methods, subdivide the area into workable sections and determine the amount of seed needed for each section. Apply one-half the seed while moving back and forth across the area, making a uniform pattern: then apply the second half in the same way, but moving at right angles to the first pass.

Mulch all plantings immediately after seeding.

G. MAINTENANCE:

Generally, a stand of vegetation cannot be determined to be fully established until soil cover has been maintained for one full year from planting, inspect seeded areas for failure and make necessary repairs and reseedings within the same season, if possible.

Reseeding: if a stand has inadequate cover, reevaluate choice of plant materials and quantities of lime and fertilizer. Reestablish the stand after seedbed preparation or overseed the stand. Consider seeding temporary, annual species if the time of year is not appropriate for permanent seeding.

If vegetation fails to grow, soil must be tested to determine if acidity or nutrient imbalance is responsible and the areas deficient in a 100% stand of grass reseeded at no additional cost to the OWNER.

Fertilization: on the typical disturbed site, full establishment usually requires refertilization in the second growing season. Fine turf requires annual maintenance fertilization. Use soil tests if possible or follow the guidelines given for the specific seeding mixture.

H. TEMPORARY SEEDING:

1. Seeding mixtures and dates:

Fall (Aug. 15 to Dec. 31)	Rate (lb/acre)
Rye (grain)	120

Late winter to early spring (Jan. 1 to May 1)	Rate (lb/acre)
Rye (grain)	120
Kobe Lespedeza	50

Note: Omit annual lespedeza when duration of temporary cover is not to extend beyond July.

Summer (May 1 to Aug. 15)	Rate (lb/acre)
German Millet	40

2. Soil Amendments:

Follow recommendations of soil tests; or apply 1,000 lb/acre ground agricultural limestone and 300 lb/acre 18-46-0 fertilizer.

3. Mulch:
Apply 4,000 lb/acre straw. Anchor mulch by tacking with asphalt, roving or a mulch anchoring tool. A disk with blades set nearly straight can be used as a mulch anchoring tool.

4. Maintenance:

Refertilize if growth is not fully adequate. Reseed, refertilize and mulch immediately following erosion or other damage.

I. PERMANENT SEEDING

1. Seeding mixtures:

Seed Mixture	Rate (lb/acre)
Tall Fescue	80
Sericea lespedeza	20
Kobe lespedeza	10

2. Nurse Plants:

From May 1 and Aug. 15, add 10 lb/acre German Millet or 15 lb/acre Sudangrass. Prior to May 1 or after Aug. 15, add 40 lb/acre Rye (grain).

3. Seeding Dates

	Best	Possible
Fall	Aug. 25 to Sept. 15	Aug. 20 to Oct. 25
Late winter	Feb. 15 to mar. 21	Feb. 1 to Apr. 15

Note: Fall is best for tall fescue and late winter is best for Lespezeda. Overseeding of Kobe Lespezeda over fall-seeded tall fescue is a recommended practice.

4. Soil Amendments:

Follow recommendations of soil tests; or apply 1,000 lb/acre ground agricultural limestone and 300 lb/acre 18-46-0 fertilizer.

5. Mulch:

Apply 4000 lb/acre grain straw or equivalent cover of another suitable mulching material. Anchor mulch by tacking with asphalt, roving or netting. Netting is the preferred anchoring method on steep slopes.

6. Maintenance:

Refertilize in the second year unless growth is adequate. May be mowed once or twice a year, but mowing is not necessary. Reseed, refertilize, and remulch damaged areas immediately.

3.02 INSTALLATION

A. Seed all disturbed areas of construction (excluding roads).

B. Refer to Part 3 for specifications on the installation of temporary and permanent seeding.

C. No seeding should be undertaken in windy or unfavorable weather, when the ground is too wet to rake easily, when it is in a frozen condition, or too dry.

D. The subgrade of all areas to be seeded shall be raked and all rubbish, sticks, roots, and stones larger than 2 inches shall be removed. All areas prepared for seeding shall be graded such that a grass stand height of four inches can be maintained by mowing without encountering any surface obstructions or irregularities.

E. The Contractor shall keep all seeded areas watered and in good condition. Reseeding shall be done if and when necessary until a good, healthy, uniform growth is established over the entire area seeded.

F. On slopes, the Contractor shall provide against washouts by an approved method. Any washout which occurs shall be regraded and reseeded at the Contractor's expense until good sod is established.

G. Staple erosion control matting in accordance with manufacturer's recommendations for the proposed applications.

3.03 MAINTENANCE

A. The Contractor shall maintain all seeded areas in a condition approved by the Engineer until provisional acceptance by the Engineer. Maintenance shall include, but not be limited to, mowing, raking clippings and leaves, repair of seeded areas, irrigation, and weed control. Protection shall be provided for all seeded areas against trespassing and damage. Slopes shall be protected from damage due to erosion, settlement, and other causes and shall be repaired promptly.

B. Mowing shall be scheduled so as to maintain a minimum stand height of 4 inches. Stand height shall be allowed to reach 7-9 inches prior to mowing.

C. All seeded areas shall be inspected on a regular basis and any necessary repairs or reseeding made within the planting season, if possible.

D. After all necessary corrective work and clean-up has been completed and maintenance instructions have been received by the Owner, the Engineer will certify in writing the provisional acceptance of the seeded areas.

3.04 GUARANTEE PERIOD AND FINAL ACCEPTANCE

A. All seeded areas shall be guaranteed for not less than 1 full year from the time of provisional acceptance.

B. At the end of the guarantee period, inspection will be made by the Owner upon written request submitted at least 10 days before the anticipated date. Seeded areas not demonstrating satisfactory stands as outlined below, as determined by the Owner, shall be renovated, reseeded and maintained meeting all requirements as specified herein.

C. After all necessary corrective work has been completed, the Owner shall certify in writing the final acceptance of the seeded areas.

D. A satisfactory stand will be defined as a section of grass of 10,000 sq ft or larger that has:

1. No bare spots larger than 3 sq. ft.

2. No more than 10 percent of total area with bare spots larger than 1 sq. ft.

3. Not more than 15 percent of total area with bare spots larger than 6-in square.

END OF SECTION

SECTION 03300

CONCRETE AND REINFORCING STEEL

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install all concrete work complete as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. Concrete Electrical Duct Encasement is included in Section 16900.

1.03 SUBMITTALS

A. Submit, in accordance with Section 01300, shop drawings and product data for:

1. Placing drawings and bar bending details in conformity with the recommendations of ACI 315.

2. Technical data on all materials and components.

3. Material Safety Data Sheets (MSDS) for all concrete admixtures and curing agents.

B. Test Reports

1. Sieve analysis, mechanical properties and deleterious substance content for fine and coarse aggregates.

2. Concrete mixes: For each formulation of concrete proposed for use, submit constituent quantities per cubic yard, water cementitious ratio, concrete slump, type and manufacturer of cement. Provide either a. or b., below, for each mix proposed.

   a. Standard deviation data for concrete mixes based on statistical records.

   b. Water cementitious ratio curve for concrete mixes based on laboratory tests. Provide average cylinder strength test results at 7 and 28 days for laboratory concrete mix designs. Provide results of 14 day tests if available.

C. Certifications

1. Certify that admixtures used in the same concrete mix are compatible with each other and the aggregates.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

2. ASTM A185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
3. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
4. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
5. ASTM C33 - Standard Specification for Concrete Aggregates.
6. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
7. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
8. ASTM C143 - Standard Test Method for Slump of Hydraulic-Cement Concrete
9. ASTM C150 - Standard Specification for Portland Cement
10. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
11. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
12. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
13. ASTM C311 - Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland-Cement Concrete.
14. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
15. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Portland Cement Concrete.

B. American Concrete Institute (ACI).

1. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
2. ACI 232.2R - Use of Fly Ash in Concrete
3. ACI 301 - Specification for Structural Concrete.
4. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete.
5. ACI 305R - Hot Weather Concreting.
6. ACI 306R - Cold Weather Concreting.
7. ACI 315 - Details and Detailing of Concrete Reinforcement.

8. ACI 318 - Building Code Requirements for Structural Concrete.

C. Concrete Reinforcing Steel Institute (CRSI)

1. MSP - Manual of Standard Practice

D. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. Comply with ACI 318, and other stated specifications, codes and standards. Apply the most stringent requirements of stated specifications, codes, standards, and this Section when conflicts exist.

B. If, during the progress of the work, it is impossible to secure concrete of the specified workability and strength with the materials being furnished, the Engineer may order such changes in proportions or materials, or both, as may be necessary to secure the specified properties. Make all changes so ordered at the no additional cost to the Owner.

C. All field testing and inspection services and related laboratory tests required will be provided by the Owner. The cost of such work will be paid for by the Owner. Methods of testing will comply with the latest applicable ASTM methods.

D. Develop concrete mixes and their testing by an independent testing laboratory engaged by and at the expense of the Contractor. Methods of testing shall comply with the latest applicable ASTM methods.

1.06 DELIVERY, STORAGE AND HANDLING

A. Ship and store reinforcing steel with bars of the same size and shape fastened in bundles with durable tags, marked in a legible manner with waterproof markings showing the same designations as those shown on the submitted placement drawings. Provide reinforcing steel free from mill scale, loose rust, mud, dirt, grease, oil, ice or other foreign matter. Store off the ground, protect from moisture and keep free from rust, mud, dirt, grease, oil, ice or other injurious contaminants.

B. Store products in conformity with the manufacturer's recommendations.

C. Store or stockpile sand, aggregates, cement and fly ash in conformity with ACI 301.

PART 2 PRODUCTS

2.01 GENERAL

A. The use of manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

B. Like items of materials shall be the end products of one manufacturer in order to provide standardization for appearance, maintenance and manufacturer's service.

C. Materials shall comply with this Section and any applicable State or local requirements.

2.02 MATERIALS

A. Cement: Domestic portland cement conforming to ASTM C150. Do not use air entraining cements. The allowable types of cement for each class of concrete are shown in Table 1.

B. Fine Aggregate: Washed inert natural sand conforming to ASTM C33.

C. Coarse Aggregate: Well-graded crushed stone or washed gravel conforming to ASTM C33, size 57. Limits of deleterious substances and physical property requirements as listed in ASTM C33, Table 3 for severe weathering regions.

D. Water: Potable water free of oil, acid, alkali, salts, chlorides, (except those attributable to drinking water) organic matter, or other deleterious substances.

E. Admixtures: Use admixtures free of chlorides and alkalis (except for those attributable to drinking water). The admixtures shall be from the same manufacturer when it is required to use more than one admixture in the same concrete mix. Use admixtures compatible with the concrete mix including other admixtures.

1. Air Entraining Admixture: Conforming to ASTM C260. Proportion and mix in accordance with manufacturer's recommendations.

2. Water Reducing Admixture: Conforming to ASTM C494, Type A. Proportion and mix in accordance with manufacturer's recommendations.

3. Do not use admixtures causing retarded or accelerated setting of concrete without written approval from the Engineer. Use retarding or accelerating water reducing admixtures when so approved.

F. Fly Ash: Class F fly ash complying with ASTM C618, including the requirements of Table 1 but with the Loss of Ignition (LOI) limited to 3 percent maximum and the optional physical requirements of Table 3.

G. Deformed Concrete Reinforcing Bars: ASTM A615, Grade 60 deformed bars.

H. Welded Steel Wire Fabric: Conforming to ASTM A185.

I. Reinforcing Steel Accessories

1. Plastic Protected Wire Bar Supports: CRSI Bar Supports, Class 1 - Maximum Protection.

2. Stainless Steel Protected Wire Bar Supports: CRSI Bar Supports, Class 2 - Moderate Protection with legs made wholly from stainless steel wire.

3. Precast Concrete Bar Supports: CRSI Bar Supports, Precast Concrete Bar Supports. Precast concrete blocks that have equal or greater strength than the surrounding concrete.

J. Tie Wires for reinforcement: 16 gauge or heavier black annealed wire.

2.03 MIXES

A. Select proportions of ingredients to meet the design strength and materials limits specified in Table 1 and to produce placeable, durable concrete conforming to these Specifications. Proportion ingredients to produce a homogenous mixture which will readily work into corners and angles of forms and around reinforcement without permitting materials to segregate or allowing free water to collect on the surface.

B. Base concrete mixes on standard deviation data of prior mixes with essentially the same proportions of the same constituents or, if not available, develop concrete mixes by laboratory tests using the materials proposed for the work.

C. Compression Tests: Provide testing of the proposed concrete mix or mixes to demonstrate compliance with the compression strength requirements in conformity with the provisions of ACI 318.

D. Entrained air, as measured by ASTM C231, shall be as shown in Table 1.

E. Slump of the concrete as measured by ASTM C143, shall be as shown in Table 1.

F. Proportion admixtures according to the manufacturer's recommendations. Two or more admixtures specified may be used in the same mix provided that the admixtures in combination retain full efficiency and have no deleterious effect on the concrete or on the properties of the other admixture(s).

TABLE 1

Class	Design Strength (1)	Cement ASTM C150	Cementitious Content (2)	W/C (3)	WR (4)	Slump Range Inches
A	2500	Type II	440	0.62 max.	Yes	1-4
B	4000	Type II	560	0.44 max.	Yes	3-5

All concrete classes shall have 3.5 to 5 percent air entrainment.

NOTES:

(1) Minimum compressive strength in psi at 28 days
(2) Minimum cementitious content in lbs per cubic yard (where fly ash is used, cementitious content is defined as cement content plus fly ash content)
(3) W/C is Maximum Water Cementitious ratio by weight
(4) WR is water reducing admixture
(5) Fly ash content in the range of 20-25 percent of the total cement content plus fly ash content, by weight

2.04 MEASURING, BATCHING, MIXING AND TRANSPORTING CONCRETE

A. Measure, batch, mix and transport concrete in conformance with ASTM C94 and the requirements herein or as otherwise approved in writing by the Engineer.

B. Ready-mixed concrete, whether produced by a concrete supplier or the Contractor shall conform to the requirements above. Do not hand mix.

C. Dispense admixtures into the batch in conformity with the recommendations of the admixture manufacturer.

D. Mix concrete until there is uniform distribution of the materials and discharge completely before the mixer is recharged. The mixer shall be rotated at a speed recommended by the mixer manufacturer and mixing shall be continued for at least 1-1/2 minutes after all the materials are in the mixer. Place concrete within 1-1/2 hours of the time at which water was first added, otherwise it will be rejected. Concrete which has been remixed or retempered, or to which an excess amount of water has been added, will also be rejected.

2.05 FORMS

A. Provide forms free from roughness and imperfections, watertight and braced and tied to prevent motion when concrete is placed. Wooden spreaders will not be allowed in the concrete.

B. Wire ties will not be allowed. Metal ties or anchorages which are necessary within the forms shall be so constructed that the metal work can be removed for a depth of at least 1-1/2-in from the concrete surface without damage by spalling. Clean forms before using and treat with form release agent, or other approved material.

C. All exposed edges of the finished concrete shall be chamfered 3/4-in.

PART 3 EXECUTION

3.01 CONSTRUCTION JOINTS

A. Locate construction joints where indicated or where approved by the Engineer.

B. Continue all reinforcing steel through the joint.

C. At construction joints and at concrete joints indicated to be "roughened", uniformly roughen the surface of the concrete to a full amplitude (distance between high and low points and side to side) of 1/4-in with chipping tools to expose a fresh face. Thoroughly clean joint surfaces of loose or weakened materials by waterblasting or sandblasting and prepare for bonding. At least two hours before and again shortly before the new concrete is deposited, saturate the joints with water. After glistening water disappears, coat joints with neat cement slurry mixed to the consistency of very heavy paste. The surfaces shall receive a coating at least 1/8-in thick, scrubbed-in by means of stiff bristle brushes. Deposit new concrete before the neat cement dries.

3.02 REINFORCING STEEL

A. Fabricate reinforcing steel accurately to the dimensions shown. Bend bars around a revolving collar having a diameter of not less than that recommended in ACI 318. All bars shall be bent cold.

B. Provide tension lap splices in compliance with ACI 318. Stagger splices in adjacent bars where possible. Provide Class B tension lap splices at all locations unless otherwise indicated.

C. Lap splices in welded wire fabric in accordance with the requirements of ACI 318 but not less than 12-in. Tie the spliced fabrics together with wire ties spaced not more than 24-in on center and lace with wire of the same diameter as the welded wire fabric. Offset splices in adjacent widths to prevent continuous splices.

D. Use precast concrete blocks where the reinforcing steel is to be supported over soil. Use plastic protected bar supports or steel supports with plastic tips where the reinforcing steel is to be supported on forms for a concrete surface that will be exposed to weather, high humidity, or liquid. Use stainless steel supports or plastic tipped metal supports in all other locations unless otherwise noted on the Drawings or specified herein.

E. Before placing in position, clean reinforcement of loose mill scale and rust, mud, dirt, grease, oil and other coatings, including ice that reduce or destroy bond. When there is a delay in depositing concrete after the reinforcement is in place, bars shall be reinspected and cleaned again when necessary.

F. Coat reinforcement which is to be exposed for a considerable length of time after being placed with a heavy coat of cement grout.

G. Do not cover any reinforcing steel with concrete until the amount and position of the reinforcement has been checked and the Engineer has given permission given to proceed.

3.03 INSPECTION AND COORDINATION

A. Batching, mixing, transporting, placing and curing of concrete shall be subject to the inspection of the Engineer at all times. Advise the Engineer of readiness to proceed at least six working hours prior to each concrete placement. The Engineer will inspect the preparations for concreting including the preparation of previously placed concrete, the reinforcing and the alignment, cleanliness and tightness of formwork. Do not place concrete without the inspection and acceptance of the Engineer.

3.04 CONCRETE APPEARANCE

A. Remix concrete showing either poor cohesion or poor coating of the coarse aggregate with paste. If this does not correct the condition, the concrete shall be rejected.

B. Provide concrete having a homogeneous structure which, when hardened, will have the specified strength, durability and appearance. Provide mixtures and workmanship such that concrete surfaces, when exposed, will require no finishing except as specified herein.

3.05 PLACING AND COMPACTING

A. Do not place concrete until forms, condition of subgrade and method of placement have been approved by the Engineer. Remove all debris, foreign matter, dirt, ice and standing water from the forms before depositing concrete. Do not place concrete on frozen subgrade, snow or ice. The contact surface between concrete previously placed and new concrete shall be cleaned and brushed with cement paste. Concrete, except as indicated on the Drawings, shall not be placed in

water or submerged within 24 hours after placing, nor shall running water be permitted to flow over the surface of fresh concrete within 4 days after its placing.

B. Deposit concrete as near its final position as possible to prevent segregation due to rehandling or flowing. Pumping of concrete will be permitted when an approved design mix and aggregate sizes suitable for pumping are used. Do not deposit concrete which has partially hardened or which has been contaminated by foreign materials. If the section cannot be placed continuously, place construction joints as specified or as approved. Place concrete for walls using tremie tubes in 12-in to 24-in lifts, keeping the surface horizontal. Do not drop concrete more than 4-ft.

C. Use high frequency mechanical vibrators to obtain proper consolidation of the concrete. Do not use vibrators to move or transport concrete in the forms. Do not over-vibrate so as to segregate. Continue vibration until the frequency returns to normal, trapped air ceases to rise and the surface appears liquefied, flattened and glistening. Use spades, rods or forks so that concrete is completely worked around reinforcement, embedded items, pipe stubs, and openings and into corners of forms.

3.06 CURING AND PROTECTION

A. Protect all concrete work against injury from the elements and defacements of any nature during construction operations.

B. Cure all concrete in conformance with ACI 301. Concrete that is to be used for the containment of water shall be water cured. Water curing shall be by ponding, by continuous sprinkling or by covering with continuously saturated burlap. Other concrete shall be cured by either water curing, sheet material curing or liquid membrane curing compound except that liquid membrane curing compound shall not be used on any concrete surface where additional concrete is to be placed or where the concrete surface is to be coated or painted.

C. Protect finished surfaces and slabs from the direct rays of the sun to prevent checking and crazing.

D. During cold weather concrete shall be batched, delivered, placed, cured and protected in compliance with the recommendations of ACI 306R. Do not use salt, manure or other chemicals for cold weather protection.

E. During hot weather concrete shall be batched, delivered, placed, cured and protected in compliance with the recommendations of ACI 305R. The temperature of the concrete shall be such that it will cause no difficulties from loss of slump, flash set or cold joints. Immediately cover plastic concrete with sheet curing material during hot weather.

3.07 FIELD TESTS

A. Sets of field control cylinder specimens will be taken by the Engineer during the progress of the work, in compliance with ASTM C31. The number of sets of concrete test cylinders taken of each class of concrete placed each day will not be less than one set per day, nor less than one set for each 150 cu yds of concrete nor less than one set for each 5,000 sq ft of surface area for slabs or walls. Specimens will be formed in 6-in diameter by 12-in long non-absorbent cylindrical molds.

1. A "set" of test cylinders shall consist of four cylinders: one to be tested at seven days and two to be tested and their strengths averaged at 28 days. The fourth may be used for a special test at 3 days or to verify strength after 28 days if 28 day test results are low.

2. When the average 28 day compressive strength of the cylinders in any set falls below the required compressive strength or below proportional minimum seven-day strengths (where proper relation between seven and 28 day strengths have been established by tests), change proportions, cementitious content, or temperature conditions to achieve the required strengths at no additional cost to the Owner.

B. Cooperate in the making of tests by allowing free access to the work for the selection of samples. Provide an insulated closed curing box for the specimens and protect the specimens against injury or loss through construction operations. Furnish material and labor required for the purpose of taking concrete cylinder samples. All shipping of specimens will be paid for by the Owner.

C. Slump tests will be made in the field by the Engineer in conformity with ASTM C143.

D. Tests for air content will be made in the field by the Engineer in compliance with either the pressure method (ASTM C231) or by the volumetric method (ASTM C173).

3.08 STRIPPING AND FINISHING CONCRETE

A. Do not remove forms before the concrete has attained a strength of at least 30 percent of the specified design strength nor before reaching approximately "100 day-degrees" of moist curing (whichever is the longer). Degree-days are defined as the total number of 24 hour periods multiplied by the weighted average daily air temperature at the surface of the concrete (e.g., 7 days at an average 50 degrees F = 350 degree-days).

B. Exercise care to prevent damaging edges or obliterating the lines of chamfers, rustications or corners when removing the forms or doing any other work adjacent thereto.

C. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete, to the satisfaction of the Engineer.

D. Immediately after removal of forms remove tie cones and metal portions of ties. Fill holes promptly upon stripping as follows: Moisten the hole with water, followed by a 1/16-in brush coat of neat cement slurry mixed to the consistency of a heavy paste. Immediately plug the hole with a 1 to 1.5 mixture of cement and concrete sand mixed slightly damp to the touch (just short of "balling"). Hammer the grout into the hole until dense, and an excess of paste appears on the surface in the form of a spider web. Trowel smooth with heavy pressure. Avoid burnishing.

E. Defective concrete and honeycombed areas: Chip down square and at least 1-in deep to sound concrete with hand chisels or pneumatic chipping hammers. Irregular voids or surface stones need not be removed if they are sound, free of laitance, and firmly embedded in the parent concrete. If honeycomb exists around reinforcement, chip to provide a clear space at least 3/8-in wide all around the steel. For areas less than 1-1/2-in deep, the patch may be made in the same manner as described above for filling form tie holes, care being exercised to use adequately dry (non-trowelable) mixtures and to avoid sagging. Thicker repairs will require build-up in successive 1-1/2-in layers on successive days, each layer being applied (with slurry, etc.) as described above.

F. Concrete to receive dampproofing and concrete not exposed in the finished work shall have off-form finish with fins and other projections removed and tie cones and defects filled as specified above.

G. Screed top surface of slabs to the established grades and to a true plane with a tolerance of 1/8-in when checked with a 10-ft straightedge. Pitch surface to drain unless otherwise noted on the Drawings. Finish the surface to give a smooth, hard, even surface free from high or low spots or other defects. Concrete subject to pedestrian traffic shall be given a broom finish. Failure to meet these conditions shall be cause for removal, grinding, or other correction as directed by the Engineer.

3.09 SCHEDULE

A. The following (Table 2) are the general applications for the various concrete design strengths to be used:

TABLE 2

Class	Design Strength (psi)	Description
A	2,500	Concrete fill and electrical raceway encasement
B	4,000	Slabs on grade and all other structural concrete

END OF SECTION

SECTION 05500

MISCELLANEOUS METAL

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install all miscellaneous metal complete as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. Painting is included in Division 9.

B. Pipe hangers and sleeves are included in Division 15.

C. Equipment anchor bolts are included in the respective Sections of Divisions 11, 14 and 15.

1.03 SUBMITTALS

A. Submit, in accordance with Section 01300, shop drawings and product data showing materials of construction and details of installation for:

1. Shop drawings, showing sizes of members, method of assembly, anchorage and connection to other members.

B. Test Reports

1. Certified copy of mill test reports on each steel, stainless steel, aluminum proposed for use showing the physical properties and chemical analysis.

1.04 REFERENCE STANDARDS

A. Aluminum Association (AA)

1. AA M31C22A41

a. M31: Mechanical Finish, Fine Satin

b. C22: Finish, Medium Matte

c. A41: Clear Anodic Coating, Class I

B. American Society for Testing and Materials (ASTM)

1. ASTM A36 - Standard Specification for Carbon Structural Steel.

2. ASTM A48 - Standard Specification for Gray Iron Castings.

3. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

4. ASTM A108 - Standard Specification for Steel Bars, Carbon, Cold Finished, Standard Quality.

5. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

6. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

7. ASTM A240 - Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Plate, Sheet, and Strip Pressure Vessels.

8. ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes.

9. ASTM A536 - Standard Specification for Ductile Iron Castings.

10. ASTM A570 - Standard Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality.

11. ASTM A1008 - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.

12. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

13. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.

14. ASTM B429 - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.

15. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

C. American Iron and Steel Institute (AISI).

1. Specification for Structural Steel Buildings.

D. American Welding Society (AWS)

1. AWS D1.1 - Structural Welding Code - Steel.

2. AWS D1.2 - Structural Welding Code - Aluminum.

3. AWS D1.6 - Structural Welding Code - Stainless Steel

E. Federal Specifications

1. FS-FF-B-575C - Bolts, Hexagonal and Square

F. Occupational Safety and Health Administration (OSHA)

G. International Code Council (ICC)

1. North Carolina State Building Code

I. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. The work of this Section shall be completely coordinated with the work of other Sections. Verify, at the site, both the dimensions and work of other trades adjoining items of work in this Section before fabrication and installation of items herein specified.

B. Furnish to the pertinent trades all items included under this Section that are to be built into the work of other Sections.

C. All welding shall be performed by qualified welders and shall conform to the applicable AWS welding code. Welding of steel shall conform to AWS D1.1 and welding of aluminum shall conform to AWS D1.2 and welding of stainless steel shall conform to AWS D1.6.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver items to be incorporated into the work of other trades in sufficient time to be checked prior to installation.

B. Repair items that have become damage or corroded to the satisfaction of the Engineer prior to incorporating them into the work.

1.07 PROJECT/SITE REQUIREMENTS

A. Field measurements shall be taken at the site, prior to fabrication of items, to verify or supplement indicated dimensions and to ensure proper fitting of all items.

PART 2 PRODUCTS

2.01 GENERAL

A. The use of manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

B. Like items of materials shall be the end products of one manufacturer in order to provide standardization for appearance, maintenance and manufacturer's service.

2.02 MATERIALS

A. Unless otherwise noted, materials for miscellaneous metals shall conform to the following standards:

1.	Structural Steel	ASTM A36, except A992 for Wide Flange Members
2.	Steel Sheets	ASTM A1008
3.	Gray Iron Castings	ASTM A48, Class 35
4.	Ductile Iron Castings	ASTM A536, Grade 65-45-12
5.	Aluminum Extruded Shapes	ASTM B221, Alloy 6061 T6
6.	Aluminum Sheet and Plate	ASTM B209, Alloy 6061 T6
7.	Stainless Steel Plates, Sheets, and Structural Shapes	
	a. Exterior, Submerged or Industrial Use	ASTM A240, Type 316 (Type 316L for welded)
	b. Interior and Architectural Use	ASTM A240, Type 304
8.	Stainless Steel Bolts, Nuts, and Washers	ASTM A276, Type 316
9.	High Strength Steel Bolts, Nuts and washers	ASTM A325 (mechanically galvanized per ASTM B695, Class 50, where noted)
	a. Elevated Temperature Exposure	Type I
	b. General Application	Type I or Type II
10.	Anchor Bolts	ASTM F1554
11.	Galvanizing	ASTM A123, Zn w/0.05 percent minimum Ni
12.	Galvanizing, hardware	ASTM A153, Zn w/0.05 percent minimum Ni

2.03 ANCHORS, BOLTS AND FASTENING DEVICES

A. Anchor bolt material shall be ASTM F1554 Grade 36 unless otherwise noted.

B. Unless otherwise noted, bolts for the connection of carbon steel or iron shall be steel machine bolts; bolts for the connection of galvanized steel or iron shall be galvanized steel or stainless steel machine bolts; and bolts for the connection of aluminum or stainless steel shall be stainless steel machine bolts.

C. Unless otherwise noted, expansion anchors shall be zinc plated carbon steel wedge type anchors complete with nuts and washers. Type 316 stainless steel wedge type anchors shall be used where they will be submerged or exposed to the weather or where stainless steel wedge type

anchors are required. When the length or embedment of the bolt is not noted on the Drawings, provide length sufficient to place the wedge and expansion cone portion of the bolt at least 1-in behind the concrete reinforcing steel. Expansion anchors shall be Hilti, Kwik-Bolt III; Simpson Strong-Tie Wedge-All; Powers Power-Stud or equal.

D. Adhesive anchors shall be a two-part stud and adhesive chemical resin anchoring system. Adhesives shall be a two-part system with manufacturer's mixing nozzle. Stud assemblies shall consist of an all-thread anchor rod with nut and washer. Adhesive capsule anchors shall be Hilti RE500 or equal.

E. Automatic end welded anchor studs shall be flux ended studs made from cold drawn steel, ASTM A108 Grades C-1010 through C-1020. Headed anchor studs shall be Nelson, H4L Headed Concrete Anchors or equal.

F. Machine bolts and nuts shall conform to Federal Specification FF-B-575C. Bolts and nuts shall be hexagon type. Bolts, nuts, screws, washers and related appurtenances shall be Type 316 stainless steel.

G. Toggle bolts shall be Hilti, Toggler Bolt or equal.

2.04 METAL GRATING

A. Grating shall have rectangular, 3/16-in thick, bearing bars spaced 1-3/16-in on center with cross bars spaced at 4-in on center. All grating panels shall be banded with a bar the same size as the bearing bars.

1. Grating shall be of the same depth shown on the Drawings, not to exceed the fabricator's maximum recommended span, and meet or exceed the following load and deflection criteria for the maximum span length at the opening being covered by the grating.

   a. The grating shall produce a deflection of 1/360 of the span or less under a uniform live load of 100 lbs/sq ft on the maximum span.

   b. The grating shall produce a deflection of 1/360 of the span or less under a concentrated live load of 300 lbs applied at the mid point of the maximum span.

2. Openings 2-in or greater in diameter/dimension and grating edges shall be banded with a bar of the same depth and thickness as the bearing bars. Cut bearing bars or cross bars shall be welded to the banding bar.

3. Grating clamps, nuts, bolts, washers and other fastening devices for grating and grating supports shall be Type 316 stainless steel. All grating shall be anchored to the supporting system using saddle clips.

B. Aluminum grating material shall be aluminum alloy 6063-T6 with a mill finish. Cross bars shall be attached to the bearing bars with interlocked swaged joints. The grating shall be Type BS by IKG Borden, Houston, TX; Type 19 SG-4 by Ohio Gratings, Inc., Canton, OH; Type 19S4 by Seidelhuber Metal Products, San Carlos, CA or equal.

C. Metal frames and supports for grating shall be of the same material as the grating unless otherwise shown on the Drawings. Where aluminum supports are used, they shall be fabricated from aluminum alloy 6061-T6.

2.05 MISCELLANEOUS ALUMINUM

A. All miscellaneous metal work shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability. Holes shall be drilled or punched. Edges shall be smooth and without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.

B. Connections and accessories shall be of sufficient strength to safely withstand the stresses and strains to which they will be subjected. Exposed joints shall be close fitting and jointed where least conspicuous. Threaded connections shall have the threads concealed where practical. Welded connections shall have continuous welds or intermittent welds as specified or shown. The face of welds shall be dressed flush and smooth. Welding shall be on the unexposed side as much as possible in order to prevent pitting or discoloration of the aluminum exposed surface. Provide holes for temporary field connections and for attachment of the work of other trades.

C. Miscellaneous aluminum items shall include: beams, angles, closure angles, grates, hatches, floor plates, stop plates, stair nosings and any other miscellaneous aluminum called for on the Drawings and not otherwise specified.

D. Angle frames for hatches, beams, grates, etc, shall be complete with welded strap anchors attached.

2.06 MISCELLANEOUS STEEL

A. All miscellaneous metal work shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability. Holes shall be drilled or punched. Edges shall be smooth and without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.

B. Connections and accessories shall be of sufficient strength to safely withstand the stresses and strains to which they will be subjected. Exposed joints shall be close fitting and jointed where least conspicuous. Threaded connections shall have the threads concealed where practical. Welded connections shall have continuous welds or intermittent welds as specified or shown. The face of welds shall be dressed flush and smooth. Provide holes for temporary field connections and for attachment of the work of other trades.

C. Miscellaneous steel items shall include: beams, angles, lintels, support brackets, base plates for other than structural steel or equipment, closure angles, holddown straps and lugs, door frames, splice plates, subframing at roof openings and any other miscellaneous steel called for on the Drawings and not otherwise specified.

D. Steel pipe pieces for sleeves, lifting attachments and other functions shall be Schedule 40 pipe unless otherwise shown on the Drawings. Wall and floor sleeves, of steel pipe, shall have welded circumferential steel waterstops at mid-length.

E. All steel finish work shall be thoroughly cleaned, by effective means, of all loose mill scale, rust and foreign matter and shall be given one shop coat of primer compatible with the finish coat after fabrication but before shipment. Paint shall be omitted within 3-in of proposed field welds. Paint shall be applied to dry surfaces and shall be thoroughly and evenly spread and well worked into joints and other open spaces.

F. Galvanizing, where required, shall be the hot-dip zinc process after fabrication. Coating shall be not less than 2 oz/sq ft of surface.

2.07 MISCELLANEOUS STAINLESS STEEL

A. All miscellaneous metal work shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability. Holes shall be drilled or punched. Edges shall be smooth and without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.

B. Connections and accessories shall be of sufficient strength to safely withstand the stresses and strains to which they will be subjected. Exposed joints shall be close fitting and jointed where least conspicuous. Threaded connections shall have the threads concealed where practical. Welded connections shall have continuous welds or intermittent welds as specified or shown. The face of welds shall be dressed flush and smooth. Provide holes for temporary field connections and for attachment of the work of other trades.

C. Miscellaneous stainless steel items shall include: beams, angles, and any other miscellaneous stainless steel called for on the Drawings and not otherwise specified.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install all items except those to be embedded in concrete or other masonry which shall be installed under Division 3 and Division 4 respectively. Items to be attached to concrete or masonry after such work is completed shall be installed in accordance with the details shown. Fastening to wood plugs in masonry will not be permitted.

B. Abrasions in the shop primer shall be touched up immediately after erection. Areas left unprimed for welding shall be painted with primer after welding.

C. Zinc coating which has been burned by welding, abraded, or otherwise damaged shall be cleaned and repaired after installation. The damage area shall be thoroughly cleaned by wire brushing and all traces of welding flux and loose or cracked zinc coating removed prior to painting. The cleaned area shall be painted with two coats of zinc oxide-zinc dust paint conforming to the requirements of Military Specifications MIL-P-15145. The paint shall be properly compounded with a suitable vehicle in the ratio of one part zinc oxide to four parts zinc dust by weight.

D. Specialty products shall be installed in accordance with the manufacturer's recommendations.

E. Expansion bolts shall be checked for tightness a minimum of 24 hours after initial installation.

F. Install adhesive capsule anchors using manufacturer's recommended drive units and adapters and in compliance with the manufacturer's recommendations.

G. Headed anchor studs shall be welded in accordance with manufacturer's recommendations.

H. All steel surfaces that come into contact with exposed concrete or masonry shall receive a protective coating of an approved heavy bitumastic troweling mastic applied in accordance with the manufacturer's instructions prior to installation.

I. Where aluminum contacts a dissimilar metal, apply a heavy brush coat of zinc-chromate primer followed by two coats of aluminum metal and masonry paint to the dissimilar metal.

J. Where aluminum contacts masonry or concrete, apply a heavy coat of approved alkali resistant paint to the masonry or concrete.

K. Where aluminum contacts wood, apply two coats of aluminum metal and masonry paint to the wood.

L. Between aluminum gratings, aluminum stair treads, or aluminum handrail brackets and steel supports, insert 1/4-in thick neoprene isolator pads, 85 plus or minus 5 Shore A durometer, sized for full width and length of bracket or support.

END OF SECTION

SECTION 09901

SURFACE PREPARATION AND SHOP PRIME PAINTING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required for the surface preparation and application of shop primers on ferrous metals, excluding stainless steels, as specified herein.

1.02 RELATED WORK

A. Finish painting is included in Section 09902.

1.03 SUBMITTALS

A. Submit to the Engineer, as provided in Section 01300 for shop drawings, manufacturer's specifications and data on the proposed primers and detailed surface preparation, application procedures and dry mil thicknesses.

B. Submit representative physical samples of the proposed primers, if required by the Engineer.

1.04 REFERENCE STANDARDS

A. Steel Structures Painting Council (SSPC)

1. SSPC-SP-6 - Commercial Blast Cleaning.

2. SSPC-SP-10 - Near White Blast Cleaning.

3. NFP 60/61.

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

PART 2 PRODUCTS

2.01 MATERIALS

A. Submerged Surfaces - Shop primer for ferrous metals which will be submerged or which are subject to splash action or which are specified to be considered submerged service shall be sprayed with one coat of Tnemec 66-1211 Epoxoline, dry film thickness 3.5 to 4.5 mils by Tnemec Co., equal coating by International, Carboline, Sherwin Williams or equal.

B. Non-Submerged Surfaces - Spray apply one coat of Tnemec 66-1211 Epoxoline Primer, dry film thickness 3.0 to 4.0 mils by Tnemec Co., equal by International, Carboline, Sherwin Williams or equal.

C. Non-Primed Surfaces - Gears, bearings surfaces and other similar surfaces obviously not to be painted shall be given a heavy shop coat of grease or other suitable rust-resistant coating. This coating shall be maintained as necessary to prevent corrosion during all periods of storage and erection and shall be satisfactory to the Engineer up to the time of the final acceptance test.

D. Compatibility of Coating Systems - Shop priming shall be done with primers that are guaranteed by the manufacturer to be compatible with their corresponding primers and finish coats specified in Section 09902 for use in the field and which are recommended for use together.

E. Surface preparation symptoms shall comply with NFP 60/61.

PART 3 EXECUTION

3.01 APPLICATION

A. Surface Preparation and Priming

1. Non-submerged components scheduled for priming, as defined above, shall be blast cleaned in accordance with SSPC-SP-6, immediately prior to priming. Submerged components scheduled for priming, as defined above, shall be blast cleaned in accordance with SSPC-SP-10, immediately prior to priming.

2. Surfaces shall be dry and free of dust, oil, grease and other foreign material before priming.

3. Shop prime in accordance with approved manufacturer's recommendations.

B. Non-Primed Surfaces

1. Apply approved coating per manufacturer's recommendations.

3.02 FABRICATED ITEMS

A. All items to be shop primed shall be blast cleaned as specified for applicable service prior to priming. If, in the opinion of the Engineer, any prime coating that has been improperly applied or if material contrary to these Specifications has been used, that coating shall be removed by abrasive blasting to white metal and reprimed in accordance with these Specifications.

B. All shop prime coats shall be of the correct materials and applied in accordance with these Specifications. Remove any prime coats not in accordance with these Specifications by blast cleaning and apply the specified prime coat at no additional cost to the Owner.

C. Shop primed surfaces shall be cleaned thoroughly and damaged or bare spots prepared as approved and retouched with the specified primer before the application of successive paint coats in the field.

SECTION 09902

PAINTING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The work of this section consists of furnishing all materials, labor, equipment, and incidentals required and performing all the painting necessary to complete this Contract in its entirety, except for the leachate tank which is covered under Section 11342.

B. It is the intent of these Specifications to paint all interior concrete where scheduled, exposed miscellaneous metal, pipe, fittings, supports, valves, equipment, and all other work obviously required to be painted unless otherwise specified. Minor items omitted in the schedule of work shall be included in the work of this Section where they come within the general intent of the specifications as stated herein.

C. The following surfaces or items are not required to be painted:

1. Portions of metal, other than aluminum, embedded in concrete. This does not apply to the back face of items mounted to concrete or masonry surfaces which shall be painted before erection. Aluminum to be embedded in or in contact with concrete or masonry shall be coated to prevent electrolysis.

2. Stainless steel.

3. Fencing.

4. Concealed surfaces of pipe or crawl spaces.

5. Acoustical ceilings.

6. Tile.

7. Exterior concrete, unless otherwise specified, and heavy duty concrete topping.

8. Finish hardware, except door closers that are not finished.

9. Manhole frames and covers.

10. Fiberglass other than piping.

11. Packing glands and other adjustable parts and nameplates of mechanical equipment.

1.02 RELATED WORK

A. Surface Preparation and Shop Prime Painting is included in Section 09901.

1.03 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO)

B. American Society for Testing and Materials (ASTM)

1. ASTM C150 - Specification for Portland Cement

2. ASTM D4258 - Practice for Surface Cleaning Concrete for Coating

C. National Science Foundation (NSF)

1. Standard 61

D. Occupational Safety and Health Act (OSHA)

1. Air Pollution Control Rules

2. Color Coding

E. Steel Structures Painting Council (SSPC)

1. SSPC-SP-1 - Surface Preparation Specification - Solvent Cleaning

2. SSPC-SP-2 - Surface Preparation Specification - Hand Tool Cleaning

3. SSPC-SP-3 - Surface Preparation Specification - Power Tool Cleaning

4. SSPC-SP-6 - Commercial Blast Cleaning

5. SSPC-SP-10 - Near White Metal Blast Cleaning

1.04 SUBMITTALS

A. Submit to the Engineer for review in accordance with Section 01300 shop drawings, working drawings, and product data including manufacturer's specifications and data on the proposed paint systems and detailed surface preparation, application procedures and dry film thickness. Certify that the systems submitted meet all applicable volatile organic carbon regulations. Equivalent systems are to be submitted at no additional costs to meet any new regulations.

B. Submit to the Engineer for review in accordance with Section 01300 color cards, including standard and special colors, for initial color selections.

C. Schedule of Painting Operations: Submit to the Engineer for review a complete Schedule of Painting Operations within 30 days after the Notice to Proceed. This Schedule is imperative so that the various fabricators may be notified of the proper shop prime coat to apply. Properly notify and coordinate the fabricators' surface preparation and painting operations with these Specifications. This Schedule shall include for each surface to be painted, the brand name, the percent volume of solids, the coverage and the number of coats the Contractor proposes to use in order to achieve the specified dry film thickness, and color charts. When the Schedule has been approved, apply all material in strict accordance with the approved Schedule and the manufacturer's instructions. Wet and dry paint film gauges shall be made available to the Engineer to verify the proper application while work is in progress.

1.05 SPARE MATERIAL

A. Furnish one unopened gallon can of each type and each color of paint used.

1.06 PRE-PAINTING CONFERENCE

A. Well in advance of commencement of painting operations, but after major equipment has been delivered, a pre-painting conference shall be held. All parties with an interest in the painting work shall attend, including the Contractor, the manufacturer, the Owner, the Engineer, and the painting subcontractor. The Contractor shall contact each party and arrange the meeting.

B. The conference shall include an inspection of the areas to be painted by all parties and a discussion of the conformance of each area with the specifications. Important issues such as environmental conditions, climate control systems, original primer, dry film thickness, and monitoring the number of coats that have been field applied shall be discussed and problems shall be resolved.

C. A written record of the meeting shall be submitted to the Engineer.

PART 2 PRODUCTS

2.01 MATERIALS

A. All painting materials shall be fully equal to those manufactured by the Tnemec Company Inc., Carboline Company, International, and Sherwin-Williams Company, or approved equal. The painting schedule has been prepared on the basis of Tnemec, Carboline, International, and Sherwin-Williams products and recommendations for applications. No brand other than those named will be considered for approval unless the brand and type of paint proposed for each item in the following schedule together with sufficient data substantiated by certified tests conducted at no expense to the Owner, to demonstrate its equality to the paint(s) named, is submitted in writing to the Engineer for approval within 30 days after the signing of the Notice to Proceed. The type and number of tests performed shall be subject to the Engineer's approval. Color availability to match those colors specified will also be considered as an important property for equality.

B. All painting materials shall be delivered to the mixing room in unbroken containers, bearing the manufacturer's brand, date of manufacture and name. They shall be used without adulteration and mixed, thinned, and applied in strict accordance with manufacturer's directions for the applicable materials and surface and with the Engineer's approval before using.

C. Shop priming shall be done with primers that are guaranteed by the manufacturer to be compatible with the finish paints to be used. Refer to Section 09901 for special primers.

D. No paint containing lead will be allowed. Oil shall be pure boiled linseed oil.

E. Work areas will be designated by the Engineer for storage and mixing of all painting materials. Materials shall be in full compliance with the requirements of pertinent codes and fire regulations. Proper containers outside of the buildings shall be provided and used for painting wastes, and no plumbing fixture shall be used for this purpose.

F. All recommendations of the paint manufacturer in regard to the health and safety of workmen shall be followed.

2.02 PAINTING SYSTEMS

A. All colors will be selected by the Engineer from color charts submitted by the Contractor.

B. The following surfaces shall have the types of paint scheduled below applied at the dry film thickness (DFT) in mils per coat noted. Some colors will require an additional coat from what is listed to get the proper color coverage. Prior to each of the four 2-coat systems, add a 1-coat primer coating of the same high solids systems, but a primer coat of 3 DFT. Thus, each system shall consist of a 3 DFT prime coat, plus 2 additional 6-8 DFT finish coats for submerged ferrous metals.

1 Ferrous metals submerged or subject to splashing:

a. Tnemec
2 Coats: 69-Color Hi-Build Pooling II (a) (6 - 8 DFT per coat)

b. Carboline
2 Coats: 890 (6 DFT per coat)

c. International
2 Coats: Interlard 760HS (7 DFT per coat)

d. Sherwin-Williams
2 Coats: Kem Cure Hi-Solids (6 DFT per coat)

2. Exterior nonsubmerged ferrous metals:

a. Tnemec
1 Coat: 69-Color Hi-Build Epoxoline II (4 - 6 DFT)
1 Coat: 73-Color Endura-Shield (2 - 5 DFT)

b. Carboline
1 Coat: 890 (4 DFT)
1 Coat: 133 H.B. (3 - 4 DFT)

c. International
1 Coat: Intergard 750HS (5 DFT)
1 Coat: Interthane 990HS or Interthane 870HS (2 DFT)

d. Sherwin-Williams
1 Coat: Recoatable Epoxy Primer, B62 Series (5 DFT)
1 Coat: Hi Solids Polyurethane, B65 Series (2.5 DFT)

3. Exterior galvanized, and non-ferrous metal:

a. Tnemec
1 Coat: 69-Color Hi-Build Epoxoline II (2 - 3 DFT)
1 Coat: 74-Color Endura-Shield (2 - 3 DFT)

b. Carboline
1 Coat: 890 (2 - 3 DFT)
1 Coat: 133 H.B. (3 - 4 DFT)

c. International
1 Coat: Intergard 447 (5 DFT)
1 Coat: Interthane 990HS or Interthane 870HS (2 DFT)

d. Sherwin-Williams
1 Coat: Heavy Duty Epoxy, B67 Series (2 - 3 mils DFT)
1 Coat: Hi-Solids Polyurethane, B65 Series (2.5 DFT)

4. Galvanized and non-ferrous metal submerged or subject to splashing:

a. Tnemec
1 Coat: 69-1211 Epoxoline II (3 - 5 DFT)
1 Coat: 69-Color Hi-Build Epoxoline II (4 - 6 DFT)

b. Carboline
2 Coats: 890 (4 - 6 DFT per coat)

c. International (sweep blast to 1.5 mils before application)
1 Coat: Intergard 447 (5 DFT)
1 Coat: Intergard 760HS (5 DFT)

d. Sherwin-Williams
1 Coat: Kem Cure Hi-Solids (4 - 6 DFT)

5. Aluminum in contact with dissimilar materials:

a. Tnemec
2 Coats: 69-Color Hi-Build Epoxoline (3 DFT per coat)

b. Carboline
2 Coats: 890 (3 DFT per coat)

c. International
2 Coats: Intergard 750HS (5 DFT per coat)

d. Sherwin-Williams
2 Coats: Heavy Duty Epoxy, B67 Series (3 DFT per coat)

6. Plastic Piping - Exterior (Sanding mandatory)

a. Tnemec
1 Coat: 69-Color Hi-Build Epoxoline II (3 - 4 DFT)
1 Coat: 73-Color Endura Shield (2 - 3 DFT)

b. Carboline
1 Coat: 890 (4 DFT)
1 Coat: 133 H.B. (2.5 DFT)

c. International
1 Coat: Intergard 750HS (3 - 5 DFT)
1 Coat: Interthane 870HS (4 DFT)

d. Sherwin-Williams
1 Coat: Macopoxy 920 Pre-Prime, B58 Series (3 - 4 DFT per coat)
1 Coat: Hi-Solids Polyurethane, B65 Series (2.5 DFT)

C. Any surfaces not specifically named in the Schedule and not specifically excepted shall be prepared, primed and painted in the manner and with materials consistent with these Specifications. The Engineer shall select which of the manufacturer's products, whether the type is indicated herein or not, shall be used for such unnamed surfaces. No extra payment shall be made for this painting.

2.03 COLOR CODING FOR PIPES AND EQUIPMENT

A. When color coding is specified, it shall consist of color code painting and identification of all exposed conduits, trough items, and pipelines for the transport of gases, liquid, and semi-liquids including all accessories such as valves, insulated pipe coverings, fittings, junction boxes, bus bars, connectors, and all operating accessories which are integral to be whole functional mechanical pipe and electrical conduit system. Colors shall be as noted in the Paint and Color Coding Schedules attached at the end of this Section.

B. All hangers and pipe support floor stands shall be painted the same color and with the same paint as the pipe it supports. The system shall be painted up to but not including the flanges attached to the mechanical equipment nor the flexible conduit connected to electrical motors. When more than one pipe system is supported on the same bracket, the bracket shall be painted the same color as the adjacent wall or ceiling. Colors shall be as noted in the Paint and Color Coding Schedule.

C. All systems which are an integral part of the equipment, that is originating from the equipment and returning to the same piece of equipment, shall be painted between and up to but not including, the fixed flanges or connections on the equipment.

D. The color code establishes, defines, and assigns a definite color for each category of pipe. Pipelines which are not listed on the Schedule of Color Code Paints shall be assigned a color by the Engineer and shall be treated as an integral part of the Contract.

E. Banding for pipes shall be as specified in the Paint and Color Coding Schedule. Bands shall be 2 in wide and located on each end of the pipe title, at 2 ft from the title bands, and at wall penetrations.

2.04 LETTERING OF TITLES

A. Each pipe system shall be labeled with the name of the materials in each pipeline and alongside this an arrow indicating the direction of flow of liquids. Titles shall be as so described in attached schedule. Titles shall not be located more than 20 linear ft apart and shall also appear directly adjacent to each side of any wall the pipeline breaches, adjacent to each side of the valve regulator, flowcheck, strainer cleanout, and all pieces of equipment.

B. Titles shall identify the contents by complete name. Identification title locations shall be determined by the Engineer but in general they shall be placed where the view is unobstructed and on the two lower quarters of pipe or covering where they are overhead. Title should be clearly visible from operating positions especially those adjacent to control valves.

C. Titles on equipment shall be applied at eye level on machines where possible or at the upper most broad vertical surface of low equipment. Where more than one piece of the equipment item to be titled exists, the items shall be numbered consecutively as indicated on the Drawings or as directed by the Engineer; for example Primary Pump No. 1, Primary Pump No. 2, Secondary Pump etc. Titles shall be composed and justified on the left hand side as follows:

Pump No. 1

D. Application of titles.

1. The color of the titles shall be black or white, as approved, to best contrast with the color of the pipes and equipment and shall be stencil applied.

2. Stencil text is to be in ALL CAPS worded exactly as shown in the Schedule. Titles are to be printed in a single line.

3. Letter sizes

Outside Diameter of Pipe or Covering (in)	Size of Legend Letters (in)
¾ to 1 1/4	1/2
1 ½ to 2	3/4
2 ½ to 6	1 1/4
8 to 10	2 1/2
More than 10	3 1/2

Equipment titles are to be 2 in high.

4. Arrow sizes. Where "a" is equal to 3/4 of outside diameter of pipe or covering, the arrow shaft shall be 2 "a" long by 3/8 "a" wide. The arrow head shall be an equilateral triangle with sides equal to "a." Maximum "a" dimension shall be 6 in..

5. When using direction arrows, point arrowhead away from pipe markers and in direction of flow. If flow can be in both directions, use a double-headed directional flow.

2.05 METAL TAGS

A. For pipelines smaller than 3/4-in in diameter, securely fasten metal tags, 2 1/2-in x 1/2-in, of Birmingham or Stubs 17 gauge brass with lettering etched and filled with enamel. Tags shall be approved by the Engineer.

2.06 FABRICATED EQUIPMENT

A. Unless otherwise indicated all fabricated equipment shall be shop primed and shop or field finished.

B. All items to be shop primed shall be thoroughly cleaned of all loose material prior to priming. If, in the opinion of the Engineer, any prime coating shall have been improperly applied or if material contrary to these Specifications shall have been used, that coating shall be removed by sandblasting to white metal and reprimed in accordance with these Specifications.

C. All shop prime coats shall be of the correct materials and applied in accordance with these Specifications. Remove any prime coats not in accordance with these Specifications by sandblasting and apply the specified prime coat at no additional cost to the Owner.

D. Shop primed surfaces shall be cleaned thoroughly and damaged or bare spots retouched with the specified primer before the application of successive paint coats in the field.

E. Be responsible for and take whatever steps are necessary to properly protect the shop prime and finish coats against damage from weather or any other cause.

F. A shop finish coat shall be equal in appearance and protection quality to a field applied finish coat. If, in the opinion of the Engineer, a shop finish coat does not give the appearance and protection quality of other work of similar nature, prepare the surfaces and apply the coat or coats of paint as directed by the Engineer to accomplish the desired appearance and protection quality. Submit to the Engineer substantial evidence that the standard finish is compatible with the specified finish coat.

G. Wherever fabricated equipment is required to be sandblasted, protect all motors, drives, bearings, gears, etc., from the entry of grit. Any equipment found to contain grit shall be promptly and thoroughly cleaned.

PART 3 EXECUTION

3.01 PREPARATION OF SURFACES

A. All surfaces to be painted shall be prepared as specified herein or in Section 09901 and shall be dry and clean before painting. Special care shall be given to thoroughly clean interior concrete and concrete block surfaces of all marks before application of finish.

B. All metal welds, blisters, etc., shall be ground and sanded smooth in accordance with SSPC-SP-10. All pits and dents shall be filled and all imperfections shall be corrected so as to provide a smooth surface for painting. All rust, loose scale, oil, grease, and dirt shall be removed by use of approved solvents, wire brushing, or sanding.

C. Concrete surfaces shall have been finished as specified in Division 3. Report unsatisfactory surfaces to the Engineer. Concrete shall be free of dust, oil, curing compounds, and other foreign matter, conforming to ASTM D4258.

D. All submerged concrete shall be brush off blast cleaned. Open all bag holes and air entrained holes with minimum aggregate exposure. Provide a uniform surface profile similar to #100 grit sandpaper.

E. Concrete block surface shall be smooth and cleaned of all dust, efflorescence, chalk, loose mortar, dirt, grease, oil, tar, and other foreign matter, conforming to ASTM D4258.

F. All plastic pipe surfaces shall be lightly sanded before painting.

G. Wood surfaces shall be dry. Sand to obtain a smooth surface. All encrustations shall be removed.

H. Exposed Pipe: Bituminous coated pipe shall not be used in exposed locations. Pipe which shall be exposed after project completion shall be primed in accordance with the requirements herein. Any bituminous coated pipe which is inadvertently installed in exposed locations shall be sandblasted clean before priming and painting. After installation all exterior, exposed flanged joints shall have the gap between adjoining flanges sealed with a single component polysulfide sealant to prevent rust stains.

I. Primed or Previously Painted Surfaces and Nonferrous Surfaces: All coated surfaces shall be cleaned prior to application of successive coats. All nonferrous metals not to be coated shall be cleaned. This cleaning shall be done in accordance with SSPC-SP-1, Solvent Cleaning.

J. Shop-Finished Surfaces: All shop-coated surfaces shall be protected from damage and corrosion before and after installation by treating damaged areas immediately upon detection. Abraded or corroded spots on shop-coated surfaces shall be "Hand Cleaned" and then touched up with the same materials as the shop coat. All shop coated surfaces which are faded, discolored, or which require more than minor touch-up in the opinion of the ENGINEER shall receive new surface preparation before being repainted. Cut edges of galvanized sheets and exposed threads and cut ends of galvanized piping, electrical conduit, and metal pipe sleeves, that are not to be finished painted, shall be "Solvent Cleaned" and primed with zinc dust-zinc oxide metal primer.

K. Galvanized and Zinc-Copper Alloy Surfaces: These surfaces to be painted shall be "Solvent Cleaned" and treated as hereinafter specified. Such surfaces not to be painted shall be "Solvent Cleaned."

L. Aluminum embedded or in contact with concrete must be painted according to the schedule for aluminum in contact with dissimilar materials.

3.02 WORKMANSHIP

A. General:

1. Primer (spot) and paint used for a particular surface shall, in general, be as scheduled for that type of new surface. Confirm with the paint manufacturer that the paint proposed for a particular repaint condition will be compatible with the existing painted surface. Sample repainted areas on the actual site will be required to insure this compatibility. Finished repainted areas shall be covered by the same guarantee specified for remainder of work.

2. At the request of the Engineer, samples of the finished work prepared in strict accordance with these Specifications shall be furnished and all painting shall be equal in quality to the approved samples. Finished areas shall be adequate for the purpose of determining the quality of workmanship. Experimentation with color tints shall be furnished to the satisfaction of the Engineer where standard chart colors are not satisfactory.

3. Protection of furniture and other movable objects, equipment, fittings and accessories shall be provided throughout the painting operations. Canopies of lighting fixtures shall be loosened and removed from contact with surface, covered and protected and reset upon completion. Remove all electric plates, surface hardware, etc., before painting, protect and replace when completed. Mask all machinery name plates and all machined parts not receiving a paint finish. Dripped or spattered paint shall be promptly removed. Lay drop cloths in all areas where painting is being done to adequately protect flooring and other work from all damage during the operation and until the finished job is accepted.

4. On metal surfaces apply each coat of paint at the rate specified by the manufacturer to achieve the minimum dry mil thickness required. If material has thickened or must be diluted for application by spray gun, the coating shall be built up to the same film thickness achieved with undiluted material. One gallon of paint as originally furnished by the manufacturer shall not cover a greater area when applied by spray gun than when applied unthinned by brush. Deficiencies in film thickness shall be corrected by the application of an additional coat(s). On masonry, application rates will vary according to surface texture, however, in no case shall the manufacturer's stated coverage rate be exceeded. On porous surfaces, it shall be the painter's responsibility to achieve a protective and decorative finish either by decreasing the coverage rate or by applying additional coats of paint.

5. Paints shall be mixed in proper containers of adequate capacity. All paints shall be thoroughly stirred before use and shall be kept stirred while using. No unauthorized thinners or other materials shall be added to any paint.

6. Only skilled painters shall be used on the work and specialists shall be employed where required.

B. Field Priming:

1. Steel members, metal castings, mechanical and electrical equipment, and other metals that are shop primed before delivery at the site will not require a prime coat on the job. All piping and other bare metals to be painted shall receive one coat of primer before exposure to the weather, and this prime coat shall be the first coat as specified in the painting schedule.

2. Equipment which is customarily shipped with a baked-on enamel finish or with a standard factory finish shall not normally be field painted unless the prefinished equipment is specifically color selected and unless the finish has not been damaged in transit or during installation. Surfaces that have been shop painted and have been damaged or where the shop coats or coats of paint have deteriorated, shall be properly cleaned and retouched before any successive painting is done on them in the field. All such field painting shall match as nearly as possible the original finish.

C. Field Painting:

1. All painting at the site shall be designated as Field Painting.

2. All paint shall be at room temperature before applying, and no painting shall be done when the temperature is below 50°F, in dust-laden air, when rain or snow is falling, or until all traces of moisture have completely disappeared from the surface to be painted.

3. Successive coats of paint shall be tinted so as to make each coat easily distinguishable from each other with the final undercoat tinted to the approximate shade of the finished coat.

4. Finish surfaces shall not show brush marks or other irregularities. Undercoats shall be thoroughly and uniformly sanded with No. 00 sandpaper or equal to remove defects and provide a smooth even surface. Top and bottom edges of doors shall be painted and all exterior trim shall be back-primed before installation.

5. Painting shall be continuous and shall be accomplished in an orderly manner so as to facilitate inspection. All exterior concrete and masonry paint shall be performed at one continuous manner structure by structure. Materials subject to weathering shall be prime coated as quickly as possible. Surfaces of exposed members that will be inaccessible after erection shall be cleaned and painted before erection.

6. All materials shall be brush painted unless spray painting is specifically approved by the Engineer. The Contractor shall be responsible for all damage caused by overspray or drifting.

7. All surfaces to be painted as well as the atmosphere in which painting is to be done shall be kept warm and dry by heating and ventilation, if necessary, until each coat of paint has hardened. Any defective paint shall be scraped off and repainted in accordance with the Engineer's directions.

8. Before final acceptance of the work, all damaged surfaces of paint shall be cleaned and repainted as directed by the Engineer.

9. Any pipe scheduled to be painted and having received a coating of a tar or asphalt-compound shall be painted with two coats of Kop-Coat's Inertol Tar Stop, Internationals Tarset Standard 7000 or equal before successive coats are applied per the schedule. Tnemec recommends using 69 Hi-Build Epoxoline II over tar, but a test patch must be run initially to test the paint's compatibility with the tar.

3.03 CLEANUP

A. The premises shall at all times be kept free from accumulation of waste material and rubbish caused by employees or work. At the completion of the painting remove all tools, scaffolding, surplus materials, and all rubbish from and about the buildings, and leave work "broom clean" unless more exactly specified.

B. Upon completion, remove all paint where it has been spilled, splashed, or splattered on all surfaces, including floors, fixtures, equipment, furniture, etc., leaving the work ready for inspection.

3.04 PAINT

A. General Notes and Guidelines:

1. All color numbers and names herein refer to master color card. Colors of specified equal manufacturers may be substituted with approval of the Engineer.

2. Pipe lines, equipment, or other items which are not listed here shall be assigned a color by the Engineer and shall be treated as an integral part of the Contract.

3. When color coding is specified or directed by the Engineer, it shall consist of color code painting and identification of all exposed conduits, through lines and pipelines for the transport of gases, liquids, or semi-liquids including all accessories such as valves, insulated pipe coverings, fittings, junction boxes, bus bars, connectors, and any operating accessories which are integral to a whole functional mechanical pipe and electrical conduit systems.

4. The colors of the Finish Schedule shall be interpreted as follows:

Colors	Tnemec #	Glidden #	Carboline #
White	AA90	4550 White	S800
Orange	SC03	Safety Orange	4444
Yellow	BW56 [SC02]	Medium Yellow	6666
Dark Yellow	BX36	Robotic Yellow	N625
Green	SC07	Safety Green	2383
Light Green	AM52	Parrot	6361
Dark Brown	AF12	Warm Brown	9218
Dark Green	□	Crylight Green 90GY 10/250	4372
Tan	AF32	Bellows	3216
Ivory	AF82	Seashell	3848
Light Grey	BG62	Concrete	C731
Medium Grey	2047	20YY 43/083	0746
Dark Grey	BK33	Silver Grey	2525
Red	SC09	Safety Red	5555

Colors	Tnemec #	Glidden #	Carboline #
Blue	SC06	Safety Blue	S150
Dark Blue	2042	70BG 10/214	A183
Medium Blue	2041	70BG 23/276	0118
Light Blue	2040	70BG 67/126	7107
Aqua	AX42	Turquoise Green 82GG 33/374	4132
International Orange	SC04	International Orange	N498
Dark Bronze	BM07	Architectural Brown	2277
Tank Blue	BB42	70BG/40/284	8155
Blue Green	AX22	Blue Lagoon 81GG 10/276	A337
Magenta	BP14	30RB 11/250	S585

5. All moving parts, drive assemblies, and covers for moving parts which are potential hazards shall be Safety Orange #CA26.

6. All safety equipment shall be painted in accordance with OSHA standards.

7. All inline equipment and appurtenances not assigned another color shall be painted the same base color as the piping. The pipe system shall be painted with the pipe color up to but not including the flanges attached to pumps and mechanical equipment assigned another color. Tanks shall be painted the color of the piping system that they serve, unless the tank is fiberglass and levels are monitored through the tank.

8. All conduit shall be painted to match its background surface.

9. Control panels shall be factory finished.

3.05 PAINT AND COLOR CODING SCHEDULE

A. Color selection for the following items are to be selected by the Engineer and reviewed by the Owner at the time of shop drawing review. Submit color charts for color selections.

Potable Cold Water	Blue
Leachate Piping	Medium Blue
Fire Hydrant	Red

END OF SECTION

SECTION 11213

HORIZONTAL, END SUCTION CENTRIFUGAL LEACHATE LOADOUT PUMP

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and completely install, put in operation and field test one horizontal end suction constant speed centrifugal pump complete with drivers, mounting arrangement and controls as shown on the Drawings and as specified herein.

B. All necessary and desirable accessory equipment and auxiliaries whether specifically mentioned in this Section or not shall be furnished and installed as required for an installation incorporating the highest standards for this type of service. Also included shall be supervisory services during installation and field testing of each unit and instructing the regular operating personnel in the proper care, operation and maintenance of the equipment.

1.02 RELATED WORK

A. Concrete work and the installation of anchor bolts are included in Division 3; however, anchor bolts for these units shall be furnished under this Section.

B. Instrumentation and control work, except as specified herein, is included in Division 13. Instrumentation and controls provided in this section shall adhere to Instrumentation and Control Specifications Sections in Division 13.

C. Valves, mechanical piping and appurtenances and pipe hangers, supports and thermal insulation are included in Division 15.

D. Electrical work, except as hereinafter specified, is included in Division 16.

E. Field painting is included in Section 09902.

1.03 SUBMITTALS

A. Submit, in accordance with Section 01300, copies of all materials required to establish compliance with this Section. Submittals shall include the following:

1. Certified shop and erection drawings showing all important details of construction, dimensions and anchor bolt locations.

2. Descriptive literature, bulletins, and/or catalogs of the equipment.

3. Data on the characteristics and performance of each size pump. Data shall include guaranteed performance curves, based on actual shop tests of duplicate units, which show that they meet the specified requirements for head, capacity, efficiency, allowable NPSH, allowable suction lift and horsepower. Curves shall be submitted on 8-1/2-in by 11-in sheets.

4. The total weight of the equipment including the weight of the single largest item.

5. A complete total bill of materials for all equipment.

6. A list of the manufacturer's recommended spare parts with the manufacturer's current price for each item. Include gaskets, packing, etc, on the list. List bearings by the bearing manufacturer's numbers only.

7. Complete data on motors.

B. Operation and Maintenance Data

1. Copies of an operating and maintenance manual for each size pump shall be furnished to the Engineer as provided for in Section 01300. The manuals shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions that are required to instruct operating and maintenance personnel unfamiliar with such equipment.

C. Test Reports

1. Each pump shall be Hydrostatically Tested with certified copies of the test results submitted to the Engineer.

1.04 QUALITY ASSURANCE

A. The equipment covered by this Section is intended to be standard pumping equipment of proven ability as manufactured by concerns having extensive experience in the production of such equipment. Units specified herein shall be furnished by a single manufacturer. The equipment furnished shall be designed, constructed and installed to operate satisfactorily when installed as shown on the Drawings.

B. The pump manufacturer shall be fully responsible for the design, arrangement and operation of all connected rotating components of the assembled mounted pumping unit and to ensure that neither harmful nor damaging vibrations occur at any speed within the specified operating range.

1.05 SYSTEM DESCRIPTION

A. The pump will be used to transfer leachate from the adjacent leachate storage tank to a tanker truck.

1.06 DELIVERY, STORAGE AND HANDLING

A. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the unit and equipment are ready for operation.

B. All equipment and parts must be properly protected against any damage during a prolonged period at the site. Store all equipment in accordance with the manufacturer's instructions.

C. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Engineer.

D. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

E. For protection of bearings during shipment and installation, the bearing shall be properly processed. Anti-friction bearings, if pre-lubricated, shall be protected in accordance with the bearing manufacturer's recommendations against formation of rust during a long period of storage while awaiting completion of installation and start-up of the machine in which they are used. Anti-friction bearings which are not pre-lubricated shall be properly treated in accordance with the bearing manufacturer's recommendation against formation of rust during a long period of storage, while waiting completion of installation and start-up, by the application of Exxon, Rust-Ban No. 392 or equal treatment.

1.07 MAINTENANCE

A. Furnish all special tools and test equipment required or the proper servicing of all equipment.

B. Furnish the following spare parts for each pump model.

1. none required

PART 2 PRODUCTS

2.01 GENERAL

A. The pumping units shall all be supplied by one manufacturer and shall be complete including pumps, motors, steel mounting arrangement, controls and appurtenances such as, but not limited to, couplings, guards and gauges.

B. All necessary foundation bolts, nuts, and washers shall be furnished and shall be Type 316 stainless steel.

2.02 CONDITIONS OF SERVICE

A. The pumps shall be Aurora Model 321 or approved equal.

B. The pumps shall be designed for the conditions of service as noted below:
Service: leachate transfer
Location: outdoors, adjacent to leachate storage tank
Capacity: 100 gpm
Total Head: 15 feet
Motor Power: 1 HP
Based on Aurora 321, 3 X 3 X 6 at 1750 rpm

2.03 MATERIALS OF CONSTRUCTION

A. Casing: Cast Iron (ASTM A48)

a. The casing will be of the end suction design with threaded suction inlet and threaded centerline discharge outlet. The casing shall have tapped and plugged holes for priming and draining. The casing bore shall be large enough to allow "back pullout" of the impeller without disturbing the casing or suction and discharge piping.

B. Impeller: Cast Iron (ASTM A48)
   a. The impeller shall be of the enclosed type, vacuum cast in one piece. It shall be finished all over, the exterior being turned and the interior being finished smooth and cleaned of all burrs, trimmings, and irregularities. The impeller shall be dynamically balanced. The impeller will be keyed to the shaft and fastened with a washer, gasket, and capscrew.

C. Shaft: Stainless Steel (AISI 416)
   a. The impeller shall be direct-coupled to the motor shaft. The motoro shaft shalled be machined to provide a keyway, and drilled and tapped to accept the impeller fastener. Stub shafts are not acceptable.

D. Case Wear Ring: Cast Iron (ASTM A48)
   a. The pump casing shall be fitted with a case wear ring to minimize abrasive and corrosive wear to the casing. The wear ring shall be of the radial type, pressed fitted into the casing.

E. Mechanical Seal
   a. Shaft sealing shall be accomplished by means of a mechanical seal with a Ni-resist seat, carbon washer, Buna-N elastomers, and stainless steel metal parts.

F. Motor
   a. The motor shall conform to the latest NEMA standards, and shall have the following characteristics:
      Enclosure: TEFC
      Number of Phases: 1
      Cycles: 60 Hz
      Voltage: 110/220 V
      Speed: 1750 rpm

2.04 PRESSURE GAUGES

A. The pumps shall be provided with two glycerin-filled suction and discharge pressure gauges with a 1/4-in NPT inlet and 4.5-in dials. The suction and discharge gauges shall be graduated to read 0 - 15 psi. The gauges shall be connected to the pump nozzles with 1/4-in copper pipe complete with "T"-handle cocks. All fittings and cocks shall be red brass. The pressure gauges shall be equal to Figure 1980 Solfrunt standard gauges, Model 150000-4 Series, by Amtek, U.S. Gauge Division.

2.05 SHOP PAINTING

A. All surfaces shall be prepared and shop primed, as part of the work under this Section, as specified in Section 09901. Field painting is included in Section 09902.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate with other trades, equipment and systems to the fullest extent possible.

B. Take all necessary measurements in the field to determine the exact dimensions for all work and the required sizes of all equipment under this contract. All pertinent data and dimensions shall be verified.

3.02 INSTALLATION

A. Installation shall be in strict accordance with the manufacturer's instructions and recommendations in the locations shown on the Drawings. Anchor bolts shall be set in accordance with the manufacturer's recommendations and setting plans.

B. Installation shall include furnishing the required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the manufacturer's recommendations.

3.04 FACTORY TESTS

A. Each centrifugal pump furnished shall be tested at the factory to verify individual performance. Certified copies of all test reports shall be submitted to the Engineer for approval prior to shipment. Each unit shall be hydrostatically tested in accordance with the Hydraulic Institute Standards.

END OF SECTION

SECTION 11314

TRAILER MOUNTED DIESEL ENGINE DRIVEN PUMP

PART1 -GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment and incidentals required and install, put into operation, and field test (1) one trailer mounted portable diesel engine driven self priming stormwater pump unit and appurtenances as specified herein.

B The trailer mounted diesel engine driven pump shall be used to remove stormwater in the cell area after each rain event during construction. Inlet protection measure shall be installed as shown on the Drawings to reduce transport of sediments by the pumps as shown on the Drawings. The pump shall be permanently installed at the low point of the stormwater segregation berm after installation of the berm and tarp as shown on the Drawings. The Contractor will be responsible for the operation and maintenance of the pump during the course of the project, including in the stormwater segregation area up until Final Completion date.

C. There shall be furnished and installed all necessary and desirable accessory equipment and auxiliaries whether specifically mentioned in these Specifications or not. This installation shall incorporate the highest standards for the type of service. The Contractor is responsible for field testing of the entire installation and in instruction of the regular operating personnel in the care, operation and maintenance of all equipment.

D. The stormwater pumping unit shall include the following:

1. A portable diesel engine driven centrifugal self-priming trash/stormwater pump.
2. An engine start-stop control system mounted on the electric set.
3. Trailer and required highway accessories.
4. 180 amp-hours rated industrial type battery with 975 cold cranking amps and cables.
5. Accessories as specified.

1.02 DESCRIPTION OF SYSTEMS

A. The pumping unit shall be trailer mounted and shall be arranged for manual starting and stopping.

B. The portable diesel engine driven pumping unit shall be of the latest commercial type and design. The unit shall include all standard accessories. Workmanship shall conform to modern practices and shall include static and dynamic balancing of rotating parts of the pumping unit. Only new and current model will be considered. The unit offered under these Specifications shall be covered by the manufacturer's standard warranty and shall meet the requirements of the Specifications set forth herein. Major exceptions to specifications will be considered sufficient cause for rejection of the machine.

1.03 QUALIFICATIONS

A. The engine driven pump unit shall be the standard product, as modified by these Specifications, of a manufacturer regularly engaged in the production of this type of equipment. The unit to be furnished shall be of proven ability and shall be designed, constructed, and installed in accordance with best practices and methods. To qualify as a manufacturer, the pump must be the principal item manufactured. To ensure unity of responsibility, the engine, controls and trailer should be furnished by the pump manufacturer.

B. The unit shall be assembled in the U.S. with over 50% of the components such as the engine, generator, auxiliary equipment, etc., manufactured in the U.S. by a manufacturer currently engaged in the production of such equipment.

C. The unit shall be shipped to the jobsite by the manufacturer, having a parts and service facility within a 250 mile radius of the jobsite.

D. All equipment furnished under this Specification shall be new, unused, and the standard product of a manufacturer having a successful record of manufacturing and servicing the equipment and systems specified herein for a minimum of five (5) years.

E. The Pumping Unit shall be as manufactured by Gorman Rupp Model T6A3-F4L, or equal.

1.04 SUBMITTALS

A. Submit to the Engineer for approval in a number as required in Section 01300, complete sets of installation drawings, schematics, and wiring diagrams which shall show details of installation and connections to the work of other Sections, and brochures covering each item of equipment.

B. In the event that it is impossible to conform with certain details of the Specifications due to different manufacturing techniques, describe completely all nonconforming aspects.

C. The submittal data for each unit shall include, but not necessarily be limited to, the following:

1. Engine Data:
   a. Manufacturer
   b. Model
   c. Number of cylinders
   d. RPM
   e. Borex stroke
   f. BMEP at full rated load
   g. Piston speed, FPM
   h. Make and model and descriptive literature of electric governor (where required)
   i. Fuel consumption rate curves at various loads

j. Engine maximum continuous pump drive duty rating

2. Pump Data:
   a. Manufacturer
   b. Model
   c. Rated gpm
   d. Rated tdh
   e. BHP
   f. Material of Construction
   g. Solids Handling Capability
   h. Certified Reprime Performance
   I. Descriptive literature, bulletins, and/or catalogs of the equipment
   j. Data on the characteristics and performance of each pump. Data shall include guaranteed performance curves, based on actual shop tests of similar units, which show that they meet the specified requirements for head, capacity, efficiency, NPSHR, submergence and horsepower. Curves shall be submitted on 8-1/2-inch by 11-inch sheets, at as large a scale as is practical. Curves shall be plotted from no flow at Shut Off Head to Pump Capacity at minimum specified TDH. Catalog sheets showing a family of curves will not be acceptable.
   k. A list of the manufacturer's recommended spare parts to be supplied in addition to those specified in paragraph 1.07, with the manufacturer's current price for each item. Including O-rings, seals, etc. on the list. List bearings by the manufacturer's numbers only.
   l. All submittal data required by the General Conditions.
   m. Furnish the number of copies required of the

1.05 OPERATING INSTRUCTIONS

A. Operating and maintenance manuals shall be furnished. The manuals shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions, etc. that are required to instruct operation and maintenance personnel unfamiliar with such equipment. The number of manuals to be furnished and any special requirements shall be as specified in Section 01730.

1.06 SPECIAL TOOLS AND SPARE PARTS

A. The manufacturer shall furnish any special tools if required for normal operation and maintenance of the equipment being furnished including the trailer.

B. The manufacturer shall furnish a complete set of critical spare parts necessary for the first year operation of the pumping system, which shall include at least the following:
1. 1-set of shaft seals for each pump supplied.
2. 1-wear plate for each pump supplied.

1.07 PRODUCT HANDLING

A. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.

B. All equipment and parts must be properly protected against any damage during a prolonged period at the site.

C. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Engineer.

D. Finished surface of all exposed openings (exhaust, etc.) shall be protected by wooden blanks, strongly built and securely bolted thereto.

E. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

F. After hydrostatic or other tests, all entrapped water shall be drained prior to shipment, and proper care be taken to protect parts from the entrance of water during shipment, storage and handling.

G. Each box or package shall be properly marked to show its net weight in addition to its contents.

1.08 WARRANTY

A. All equipment supplied under this section shall be warranted for a period of one (1) year by the Contractor and the equipment manufacturer(s). Warranty period shall commence on the date of Owner acceptance as outlined Section 01740.

B. The equipment shall be warranted to be free from defects in workmanship, design and materials. If any part of the equipment should fail during the warranty period, it shall be replaced in the machine(s) and the unit(s) restored to service at no expense to the Owner.

C. The manufacturer's warranty period shall run concurrently with the Contractor's warranty period. No exception to this provision shall be allowed.

PART 2 - PRODUCTS

2.01 ENGINE

A. The engine shall be full compression ignition, four cycle, single acting,air cooled, not less than four (4) cylinder type, with 230.1 cu. inch displacement, Deutz Model F4L912, or equal. Speed shall not exceed 1800 revolutions per minute (rpm) at normal full load operation. Engine shall be furnished with an instrument panel with the following indicators: alternator failure light, oil pressure gauge, ammeter, hourmeter, and tachometer.

B. Maximum continuous BHP shall be 63 HP at 2300 rpm and maximum dynamic BHP of 80 HP at 2800 rpm.

C. The engine shall be capable of satisfactory performance on No. 2 fuel oil (ASTM Designation D396). Diesel engines requiring a premium fuel will not be considered.

D. The engine shall be equipped with fuel filters, lube oil filters, intake air filters, fuel pump

residential type muffler, and unit mounted instruments. Unit mounted instruments shall include a start-stop switch, tachometer, battery charge ammeter and lubrication oil pressure gauge. The engine shall be provided with safety shutdown switches for low oil pressure and mechanical shutdown for fan belt failure. The engine shall operate for a minimum of 17.5 continuous hours on one tank of fuel. Fuel tank shall have 38.9 US gallon capacity. Engine to be furnished with 180 amp hours-rated industrial-type battery with 975 cold cranking amps and cables.

2.02 SELF-PRIMING TRASH/STORMWATER PUMP

A. The pumps shall be horizontal, self-priming trash/stormwater pump, specifically designed for pumping stormwater, sediments, and floatable solids generally encountered on construction sites. The pump shall have 6-inch suction connection, and 6-inch discharge connection.

B. All areas of the pump casing and volute which are exposed to sewage shall be constructed of cast iron of no lesser grade than Class 30.

C. All openings, internal passages, and internal recirculation ports shall be large enough to permit the passage of a sphere 3-inches in diameter, and any trash or stringy material which can pass through the average house collection system. Screens or any internal devices that create a maintenance nuisance or interfere with priming and performance of the pump shall not be permitted. Certified dimensional drawings indicating size and locations of the priming recirculation port or ports shall be submitted to the engineer for approval prior to shipment.

D. Pump Performance

1. The pump must have the necessary characteristics and be properly selected to perform under these operating conditions:

Total Dynamic Suction Lift, in feet	25	5
Capacity, in gpm	500	1,600
Total Dynamic Head, in feet	110	30
Maximum Repriming Lift, in feet	24	24
RPM	1,800	1,800
Shutoff, in feet	133	133

2. Consideration shall be given to the sanitary sewer service anticipated in which occasionally debris will lodge between the pump suction check valve and seat, resulting not only in loss of the suction leg, but also in the syphoning of liquid from the pump casing to the approximate center line of the impeller. Such occurrence shall be considered normal with proper installation of air release line free to atmosphere.

   In consideration of such occurrence and of the unattended operation anticipated, the pump shall be designed to retain adequate liquid in the pump casing to insure unattended automatic repriming while operating at its rated speed in a completely open system without suction check valves and with a dry suction leg.

E. Reprime Performance

1. Pumps must be capable of a reprime lift of 24 feet at the selected speed and impeller diameter. Reprime lift is defined as the static height of the pump suction centerline above liquid that pump will prime; and a delivering pump is shut down with the suction check valve removed. Additional standards which reprime tests shall be run are:

   a. Piping shall incorporate a spring loaded discharge check valve down stream from the pump.
   b. No restrictions shall be present in pump or suction piping which could serve to restrict the rate of siphon drop of the suction leg. Suction pipe configuration for reprime test shall incorporate an appropriate length of spipe and one 90-degree ell.
   c. Impeller shall be set at the clearances recommended by the
   d. Reprime lift repeatability shall be demonstrated by five
   e. Liquid to be used for reprime test shall be water.

2. Certified reprime performance test data, prepared by the pump manufacturer and certified by a registered professional engineer, shall be submitted to the engineer for approval prior to shipment.

F. No special tools shall be required for replacement of any components within the pump. The pump must be equipped with a removable cover plate, allowing access to pump interior to permit the clearance of stoppages and to provide simple access for service and repairs without removing suction or discharging piping.

G. The pump shall be fitted with a replaceable wear plate. Replacement of he wear plate, impeller, seal, and suction check valve shall be accomplished through the removable cover plate. The entire rotating assembly, which includes bearings, shaft, seal, and impeller, shall be removable as a unit without removing the pump volute or piping.

H. The pump shall incorporate a suction valve that can be removed or installed through the removable cover plate opening, without disturbing the suction piping. Sole function of check valve shall be to eliminate re-priming with each cycle. Pumps requiring suction check valves to prime or reprime will not be acceptable.

I. Means shall be provided for external adjustment of the clearance between the impeller and wear plate.

J. The impeller shall be two-vaned, semi-open, non-clog, cast in ductile iron with integral pump out vanes on the back shroud. Impeller shall thread onto the pump shaft and be secured with a lockscrew. Impeller shall be cast in one piece and shall be statically and dynamically balanced.

K. Impeller pump shaft shall be carbon steel per ASTM A470. The pump shaft shall be sealed against leakage by a mechanical seal. Both the stationary sealing member and mated rotating member shall be of tungsten titanium carbide alloy. `shall be` Each of the mating surfaces lapped to a flatness of one-half light band (5.8 millionths of an inch), as measured by the optical flat under monochromatic light. The stationary seal seat shall be double floating so that faces will not lose alignment during periods of shock loads that will cause deflection, vibration, and axial or radial movement of the pump

shaft. The seal shall be lubricated with oil from a separate, oil-filled reservoir. The same oil shall not be used to lubricate both shaft seal and shaft bearings. The seal shall be warranted for a minimum of four (4) years from date of shipment. Should the seal fail within the first year, the manufacturer shall be obligated, upon notification, to furnish a new seal, without charge to Owner, F.O.B. factory. The cost of replacement seals thereafter will be on a pro-rated basis as follows:

Failure Within	Percentage of New Seal Price
2 years	25%
3 years	50%
4 years	75%

L. The pump impeller shaft bearings shall be anti-friction ball or tapered roller bearings, of ample size and proper design to withstand all radial and thrust loads which can reasonably be expected during normal operation. Bearings shall be lubricated from a separate reservoir. Pump designs in which the same oil lubricates both the shaft bearings and the shaft seal shall not be acceptable.

2.03 TRAILER

A. The pumping unit set shall be mounted and fully housed on a factory fabricated trailer.

B. Pump and engine assembly shall be mounted on a two-wheel highway trailer assembly with P235/75 R15 tires, heavy duty suspension springs and shock absorbers for highway speeds, fenders, U.S. Department of Transportation two full running/stop lights, four side lights and six reflectors, inertia type braking system with 12x2 hydraulic surge brakes, 2" ball hitch and safety chains, 2000 lb. steel support jacks front and rear.

C. The trailer shall conform with all local, state, and federal highway and safety regulations.

2.04 HOSE AND FITTINGS

A. Provide one suction hose, smooth bore, 6 inch diameter x 40 feet each length, with quick type couplings.

B. Provide one length of discharge hose, smooth bore, 6 inch diameter x 50 feet each length, with quick type couplings.

C. Provide quick coupling adapters on suction and discharge of pump.

D. Provide fully enclosed suction strainer capable of preventing pump from applying suction "seal" to plastic tarp in stormwater basin.

PART 3 - EXECUTION

3.01 PAINTING

The pumping unit and associated equipment shall be shop primed and finish coated in accordance with the manufacturer's standard practice prior to shipment. Color shall be

approved by the Engineer and an adequate supply of touch-up paint shall be supplied by the manufacturer.

3.02 INSPECTION AND TESTING

A. General

1. The Engineer shall have the right to inspect, test or witness tests of all materials or equipment to be furnished under these Specifications, prior to their shipment from the point of manufacture.
2. The Engineer shall be notified in writing prior to initial shipment, in ample time so that arrangements can be made for inspection by the Engineer.
3. The Engineer or his representative shall be furnished all facilities, including labor, and shall be allowed proper time inspection and testing of material and equipment.
4. Materials and equipment shall be tested or inspected as required by the Engineer, and the cost of such work shall be included in the cost of the equipment. The Contractor shall anticipate that delays may be caused because of the necessity of inspection, testing and accepting materials and equipment before their use is approved.
5. The services of a factory representative shall be furnished for one (1) day and he shall have complete knowledge of proper operation and maintenance to inspect the final installation and supervise the test run of the equipment. With the permission of the Owner these services may be combined with those provided under Paragraph 1.05, OPERATING INSTRUCTIONS.

B. Pumps

1. Conduct in the presence of the Engineer, such tests as are necessary to indicate that pumps conform to the Specifications. Supply all electric power, fuel, water or wastewater, labor, equipment and incidentals required to complete the field tests.

2. If the pump performance does not meet the Specifications, corrective measures shall be taken or the pump shall be removed and replaced with a pump which satisfies the conditions specified.

END OF SECTION

SECTION 11323

SUBMERSIBLE LEACHATE PUMPS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The installation shall, at a minimum, consist of submersible leachate pumps and controls, discharge piping and all appurtenances as shown on the Drawings and as specified herein. Electrical Leads and Connections are specified in Division 16.

1.02 SUBMITTALS

A. The following shall be submitted in accordance with Section 01300:

1. Shop and erection drawings showing all important details and dimensions.

2. Descriptive literature, bulletins and/or catalogs of the equipment.

3. Data on the characteristics and performance of each pump. Data shall include guaranteed performance curves, which show that they meet the specified requirement for total head, capacity, efficiency, NPSHR, submergence and horsepower. Curves shall be submitted on 8-1/2-inch by 11-inch sheets, at an adequate scale. Curves shall be plotted from zero flow at shut off head to pump capacity at minimum specified total head.

4. Drawings showing the layout of the control panels. The layout shall show front and side elevations and shall indicate every device mounted on the inner door and subpanel with complete identification.

5. Complete wiring diagrams and schematics of all power and control systems showing wiring requirements between all system components, motors, sensors, control panels and related systems.

6. A complete list of the equipment ordered.

7. Manufacturer/supplier warranty.

B. In the event that it is impossible to conform to certain details of the specifications due to different manufacturing techniques, the submittal shall describe completely all nonconforming aspects.

C. Operating and Maintenance Data

1. Operating and maintenance manuals shall be furnished. The manuals shall be prepared specifically for the equipment furnished and installed and shall include all required cross sections, drawings, equipment lists, descriptions, etc. that are required to instruct operating and maintenance personnel unfamiliar with such equipment.

2. A factory representative, who has complete knowledge of proper operation and maintenance, shall be provided for one day to instruct representatives of the Owner on proper operation and maintenance.

1.03 QUALITY ASSURANCE

A. To assure unity of responsibility, the pump, control panel and other auxiliary equipment and materials specified in this section shall be furnished and coordinated by the pump manufacturer. The Contractor and manufacturer shall assume responsibility for the satisfactory installation and operation of the entire pumping system including pump and control as specified.

B. The submersible pump and other equipment covered by these specifications are intended to be of standard design and proven ability. The primary and secondary leachate pumps shall be designed for side slope riser installation and shall be equipped with a level sensing system. The pumps shall be wheeled sump drainer with pressure transducer (WSDPT) Submersible Pump manufactured by EPG Companies, Inc., or equal. The furnished pump shall be designed, constructed and installed in accordance with the Hydraulic Institute Standards and shall operate satisfactorily when installed.

C. The control system shall have an established record of successful performance for similar service.

D. All equipment furnished under this specification shall be new and unused, shall be the standard product of a manufacturer having a successful record of manufacturing and servicing the equipment and systems specified herein for a minimum of 3 years.

E. The pump furnished under this specification shall be new and unused, shall be the standard product of a manufacturer having a successful record of manufacturing and servicing the equipment and system specified herein for a minimum of 5 years.

1.04 DELIVERY, STORAGE AND HANDLING

A. All equipment and parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is complete and the units and equipment are ready for operation.

B. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Engineer.

C. Finished surfaces of all exposed pump openings shall be protected per manufacturer recommendations.

D. After hydrostatic or other tests, all entrapped water shall be drained before shipment and proper care shall be taken to prevent the entrance of water into parts during shipment, storage, and handling.

E. Each box or package shall be properly marked to show its net weight and its contents.

1.05 WARRANTY REQUIREMENTS

A. All equipment supplied under this section shall be under warranty for a period of one year by the Contractor and the equipment manufacturers. Warranty period shall commence on the date of final acceptance.

B. The warranty shall guarantee the equipment to be free from defects in workmanship, design, and materials. If any part of the equipment should fail due to manufacturing defects during the warranty period, it shall be replaced and the unit shall be restored to service at no additional cost to the Owner.

C. The manufacturer's warranty period shall run concurrently with the Contractor's warranty period. No exception to this provision shall be allowed.

1.06 ADDITIONAL WARRANTY REQUIREMENTS

A. Pump

1. The warranty shall cover defects in workmanship and materials and all costs for both labor and parts required to inspect and repair pump equipment delivered to the pump manufacturer's authorized repair and maintenance service center. During the one-year warranty period, the Contractor shall be responsible for removing and reinstalling the pump equipment. The Contractor shall be responsible for all transportation and shipping costs for delivery of the pump equipment to the service center and for its return to the site.

B. Control Panels

1. Control panel shall be provided with a warranty covering 100 percent of the cost for repair or replacement of defective equipment concurrent with warranty period for pump.

2. Warranty service to inspect defects in the control panel shall be performed at the pump station site by the Contractor and/or the pump manufacturer/supplier. Repair and/or replacement of defective components to the greatest extent possible shall be performed at the project site; however, no major component, whose removal will render the equipment or pump station inoperable, shall be removed without providing a spare or "loaner" replacement component for use and operation of the pump station while the original component is being repaired.

C. Agreement to Warranty Conditions

1. The pump manufacturer/supplier shall, as a part of the required shop drawing and product submittal data, deliver a certified statement of agreement and materials to be supplied and installed under this section.

2. Operating and maintenance data, a typewritten or printed copy of the product warranties, including the above provisions and applicable dates of commencement and expiration of each warranty period, shall be supplied with other required product data.

1.07 PATENTS AND LICENSES

A. The pump equipment manufacturer shall be responsible for all patents or licenses that exist for the equipment provided.

B. The manufacturer shall assume all costs of patent fees or licenses for the equipment or process and shall safeguard and save harmless the Owner from all damages, judgements, claims and expenses arising from license fees, or claimed infringement of any letters, patent or patent rights, or fees for the use of any equipment of process, structural feature or arrangement of any of the component parts of the installation and the price bid shall be deemed to include payment of all such patent fees, licenses or other costs pertaining thereto.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. The manufacturer shall submit a data sheet specific to each pump supplied, the data sheet shall have the name of the manufacturer, the rated capacity, total head, speed and all other pertinent data.

2.02 PUMPING SYSTEM - GENERAL

A. Provide three pumps for the Primary Leachate Pump Station, of which one is to be stored onsite as a spare. The primary leachate pumps for each pump station shall be as follows:

- Primary Pump Station –The pump curve shall satisfy the following:
  - Primary operating point - 50 gpm at 135 feet total head
  - Shutoff head - 0 gpm at 163 feet total head
  - The pump shall be wheeled sump drainer with pressure transducer WSDPT 15-5 by EPG Companies, Inc or equivalent equal.

B. Provide two secondary system pumps, of which one is to be stored onsite as a spare. The secondary system pump shall be wheeled sump drainer with pressure transducer WSDPT 1.5-2 by EPG Companies, Inc or equal. The pumps shall be capable of pumping 10 gallons/minute against a 33-foot total hydraulic head.

The pump controls shall be set as indicated IN Paragraph 2.05

2.03 PUMP CONSTRUCTION

A. The materials of pump construction shall be as follows:

Impeller	304 Stainless Steel
Impeller Seal Ring	Teflon
Motor Adaptor	304 Stainless Steel
Inlet Screen	304 Stainless Steel

Pump Shaft	431 Stainless Steel
Coupling	304 Stainless Steel
Check Valve Housing	304 Stainless Steel
Check Valve	304 Stainless Steel
Check Valve Seat	304 Stainless Steel
Diffuser Chamber	304 Stainless Steel
Fasteners	304 Stainless Steel
Bearing	Teflon or E-Glide®
Suspension Cables	304 Stainless Steel

2.04 SUBMERSIBLE MOTORS

A. All submersible leachate pumps specified herein shall come with 60 Hz, 230 volts, single-phase motors.

B. The motors shall be squirrel-cage induction type motor for submersible application and conform to NEMA standards.

C. All materials coming in contact with leachate shall be 300 series stainless steel, Teflon or viton.

D. The motor shall not require the use of oil or grease for lubrication.

E. The motor shall have a Kingsbury type thrust bearing, or equal and be capable of handling the maximum thrust load of the pump.

F. Motor pressure equalizing diaphragm assembly shall be viton.

G. Motors shall comply with all requirements of Division 16 of these specifications.

H. The pump shall be supplied with power and sensor conductors encapsulated in a single cable. Pump motor cables shall be sized to meet applicable NEC requirements. The cable entry system shall be field serviceable. Any cable entry system requiring epoxy silicones or other secondary sealing systems shall not be acceptable.

I. Pump electrical cables shall be of sufficient length that the cables will be continuous between the pump and the control panel with no splices being allowed. The motor cable shall be of the MSHA type insulated cable with a double jacketed protection system, neoprene outside, synthetic rubber inside, exceeding industry standards for oil, gas, and sewerage resistance.

2.05 PUMP CONTROL SYSTEM

A. General

1. The primary and secondary leachate pumps shall be provided with EPG L960PT controller or equivalent equal capable of controlling the two primary pumps in duplex mode and the secondary leachate pump independently of the primary pumps.

2. Each control panel shall respond to the liquid level sensor to automatically start and stop

pump to remove leachate in response to changes in liquid levels.

3. The pump control panel shall be the standard system of the manufacturer as modified for this application.

4. Provide control panel with lightning and surge protection.

5. The control panels shall be equipped with high level alarm system.

4. Electric power to be furnished to each control panel shall be 60 Hz, 230 volts, single-phase.

B. Operation Requirements

1. The control panels shall contain a main circuit breaker, a motor circuit protector, a magnetic starter for each pump motor, and a circuit breaker for a control power transformer.

2. Selector switches shall provide means to operate the pump manually or automatically.

3. The manufacturer shall provide a complete and fully functional control system to manually or automatically operate the pump as specified herein and in other applicable sections of these specifications. All manufacturer's recommended safety devices shall be furnished to protect operators. All control devices, unless specified otherwise, shall be mounted in the control panel.

4. Normally open dry contacts shall be provided on high level alarm, motor failure alarm and pump run indicators for remote monitoring.

5. A pressure sensor type liquid level control system for each individual pump shall continuously provide liquid level indication and control operation. The pressure transmitter level sensor shall have a range of 0 to 11.5 feet with a 4 to 20 MA output signal and shall be accurate to within 0.1 inch.

C. Construction

1. The electrical control equipment shall be mounted within a pad-lockable NEMA Type 12 dead-front enclosure constructed of not less than 14 gauge . The enclosure shall be equipped with a removable back panel on which control components shall be mounted. Back panel shall be secured to enclosure with collar studs. The outer door shall be equipped with a three-point latch and hold-open hardware.

2. Components

a. All motor power and control components are to be NEMA rated and be of the highest industrial quality, securely fastened to the removable back panels with screws and lock washers. Back panels shall be tapped to accept all mounting screws. Self-tapping screws shall not be used to mount any component.

b. A main circuit breaker shall be installed to provide a means of disconnecting power to

the Control Panel. The disconnect handle shall be mounted on the cabinet door.

c. A motor circuit protector (MCP) shall be provided for the pump motor. MCPs shall be "MagGard" as manufactured by Square D Company, or equal.

d. An open frame, across-the-line, NEMA rated, magnetic motor starter, Class 8539 as manufactured by Square D Company, or equal, shall be furnished for the pump motor. All motor starters shall be equipped with solid state overload relays with phase loss/unbalance protection and overload trip alarm contacts, release and overload protection on all three phases. Motor starter contacts shall be easily replaceable without removing the motor starter from its mounted position. Overload reset push-buttons shall be located on the cabinet door.

e. A control power transformer shall be provided. The transformer Neutral shall be grounded. A circuit breaker shall be provided on the secondary for the control circuit.

f. The control diagrams and overload tables shall be laminated to the inside of the cabinet door.

g. Print storage pockets shall be provided on the side of each panel. Pocket size shall be sufficient to hold all of the prints required to service the equipment. Reduced drawings shall be provided to be stored in these pockets.

h. Digital Level Control: The level meter shall be mounted on the cabinet door. Meter shall have a digital readout and the capacity to monitor and perform pumping operations for Pump Stop, Pump Run and High level signals. Level control shall be accurate to within 0.1 inch. On the Primary Pump Control Panel, provide a selector switch, mounted on the cabinet door, to select level transmitter no. 1 or no. 2 as the input to the controller.

i. Corrosion Inhibitor Emitter: Inclusion of an industrial corrosion inhibitor emitter that shall protect internal components of control panel from corrosion for up to one year. One spare emitter shall be provided for each control panel.

j. The completed control panel assembly shall be U.L. certified.

k. A loss of power relay shall be provided with dry contacts for remote monitoring.

l. A control relay shall be provided to lockout pump operation from a remote signal.

m. Lightning and surge protection connected to the pump load terminals shall be as manufactured by Advanced Protection Technologies, TE/4000 XHP, or equal.

n. All control panel wiring shall be numbered at both ends with typewritten, heat shrinkable wire markers.

o. Wiring shall be stranded copper, minimum size #14 AWG (except for shielded instrumentation cable), with 600-volt, 90-degree-C, flame retardant, type MTW

thermoplastic insulation.

p. All foreign voltage control wiring shall be yellow.

q. Terminal blocks shall be provided for all conductors entering and exiting the control panel.

r. The control panel shall be provided with nameplates identifying each component, selector switches, pilot lights, etc. Nameplates shall be permanently affixed using an epoxy process (inner door nameplates shall be fastened with stainless steel screws). Nameplates shall be laminated plastic, engraved white letters with a black background.

s. All control panels shall be provided with a master nameplate located on the cabinet door.

t. Provide a nameplate which reads as follows: "CAUTION - THIS PANEL CONTAINS A VOLTAGE FROM AN EXTERNAL SOURCE." Letters shall be black on a high visibility yellow background.

3. Operating Controls and Instruments

a. All operating controls and instruments shall be securely mounted on the cabinet door. All controls and instruments shall be clearly labeled to indicate function.

b. Pump mode selector switches shall be Hand-Off-Auto type to permit override of automatic level control and manual operation or shutdown of the pump motor. Operation of pump in manual mode shall bypass all safety shutdown circuits except pump motor overloads. Switches shall be NEMA type 4/13 as manufactured by Allen Bradley, or equal, three position switches, each of which shall be clearly labeled according to function.

c. Indicator lamps shall be LED, full voltage, NEMA type 4/13 as manufactured by Allen Bradley. Lamp modules shall operate at 24- or 120-volt input. Lamps shall be easily replaceable from the front of the cabinet door without removing lamp module from its mounted position.

d. A six-digit non-reset elapsed time meter shall be connected to each motor starter to indicate the total running time of each pump in "hours" and "tenth of hours." The elapsed time meters shall be Bulletin 705, HK Series as manufactured by Eagle Signal, or equal.

e. The following spare parts shall be furnished:
   1) 1 indicator light of each type furnished.
   2) 2 control relays of each type furnished.
   3) 1 set of thermal overloads for each type furnished.

f. Each pump shall have an amp meter to indicate running current of the motor.

g. Electronic alternator shall be provided to automatically alternate pump operation in the duplex pump control panels. A selector switch on the cabinet door shall provide selection of alternator operation or either pump 1 or 2 operation under the Auto mode. In all selector positions, when the selected pump is tripped out on its overloads, the other pump shall start automatically.

2.06 DISCHARGE PIPING AND APPURTENANCES

A. Pump discharge tubing shall be SDR11 HDPE pipe.

B. Tubing shall be 2-inch diameter for the primary and 1-inch diameter for the secondary pumps. Contractor shall furnish and install all fittings and accessories necessary to connect tubing to the pump discharge and the sideslope riser end at the pump station.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation shall be in strict accordance with the manufacturer's instructions and recommendations in the locations shown on the Drawings. Installation shall include furnishing oil and grease for initial operation, if required, in accordance with the manufacturer's recommendations.

B. The Contractor shall submit a certificate from the equipment manufacturer stating that the equipment is ready for operation and that the operating personnel have been suitably instructed in the operation, lubrication and care of each unit.

C. Primary Pump Operating Levels – the pump's level transmitter controls shall be calibrated for the following operations (with all levels measured from the invert of the 18-inch pipe):

Stop	0'-9"
Start one pump	1'-9"
Start second pump (2 pumps on).	2'-9"
High Level Warning	3'-3"
High Level Alarm	3'-9"

D. Secondary Pump Operating Levels – the pump's level transmitter controls shall be calibrated for the following operations (with all levels measured from the invert of the 18-inch pipe):

Stop	0'-9"
Start	1'-3"
High Level Alarm	1'-11"

3.02 INSPECTION AND TESTING

A. General

1. The Engineer shall have the right to inspect, test or witness tests of all materials or equipment to be furnished under these specifications, prior to their shipment from the point of assembly.

2. The Engineer shall be notified in writing prior to the initial shipment or testing, in ample time so that arrangements can be made for inspection by the Engineer.

3. The pump manufacturer shall perform the following test on each pump prior to shipment from the factory.
   a. Meter motor and pump for insulation breaks or moisture.
   b. Prior to submergence, the pump shall be ran and checked for correction rotation.
   c. Pump shall be run for a minimum of 30 minutes in a submerged condition.
   d. The pump shall be removed from test tank, meggered immediately for moisture and upper and lower seal unit shall be checked for water intrusion.
   e. A written certification test report regarding the above test shall be supplied with each pump at the time of shipment.

4. The services of a factory representative shall be furnished for one half day. This representative shall have complete knowledge of the proper operation and maintenance of the equipment and shall inspect the final installation and supervise the test run of equipment.

5. Field tests shall not be conducted until the entire installation is complete and ready for testing.

6. If the equipment does not meet the Final Acceptance Test, the Contractor shall, at the Contractor's own expense, make necessary changes and adjustments in the equipment and shall conduct further tests until full satisfaction is indicated by the Engineer and written certification of this satisfaction is received.

7. The Contractor shall be responsible for supplying water to the pump station to meet the requirements of this Section.

8. All three pumps supplied shall be installed, tested and shall remain operational after the final acceptance test.

B. Pump

1. After the pump has been completely installed and, working under the direction of the manufacturer, the Contractor shall conduct, in the presence of the Engineer, such tests as are necessary to indicate that the pump conforms to the specifications. Supply all electrical power, water, labor, equipment and incidentals required to complete the field tests.

2. The Final Acceptance Test shall demonstrate that all items of these specifications have been met by the equipment as installed and shall include, but not be limited to, the following tests:
   a. That the unit has been properly installed and is in correct alignment.
   b. That the unit operates without overheating or overloading any parts without objectionable vibration.
   c. That there are no mechanical defects in any of the parts.
   d. That the pump can deliver the specified pressure and quantity of landfill leachate.

e. That the level sensor and pump control system operates as specified.

3. If the pump performance does not meet the specifications, corrective measures shall be taken or the pump shall be removed and replaced with a pump which satisfies the conditions specified. A 24-hour operating period of the pump will be required before acceptance.

C. Motors

1. The Contractor shall check all motors for correct clearance and alignment in accordance with the manufacturer's instructions. The Contractor shall check the direction of rotation of all motors and reverse connections if necessary.

END OF SECTION

SECTION 11342

POWDER EPOXY COATED STEEL BOLTED LEACHATE STORAGE TANK

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment and incidentals required and erect a new factory epoxy coated bolted carbon steel primary and secondary tank for storage of leachate from a construction and demolition (C&D) debris landfill. The bolted tank shall be either a tapered or flat panel design. American Petroleum Institute (API 12B) flanged panel tank design shall not be acceptable for this project. The factory-applied tank interior coating shall be chemically resistant to C&D landfill leachate environment.

B. The Contractor shall design, furnish, install, test, and perform any other incidentals required to provide an operable tank as specified herein and shown in the Drawings. The scope of work shall include, but not be limited to, tank foundation design and construction, secondary containment, tank erection, tank coating, installation of tank appurtenances such as a level indicator, transfer pumps, flow meter, and the ultimate water tightness of the complete installation and any other work shown on the Drawings.

1.02 RELATED WORK

A. Earthwork is included in Division 2.

B. Piping is included in the respective Sections of Divisions 2.

C. Loadout Pump is specified in Section 11213.

D. Electrical is included in Division 16.

1.03 QUALIFICATIONS

A. The tank shown on the Drawings and specified herein shall be a new factory epoxy coated bolted carbon steel tank with either a tapered or flat panel design. Tank manufacturers shall specialize in thermoset epoxy coated bolted carbon steel tank construction and erection. The tank shall be constructed and coated in the manufacturers owned and operated facility. Facility quality process shall be ISO 9001 certified.

B. The manufacturer shall be responsible for actual erection and workmanship of the tanks. If the manufacturer chooses to provide certified subcontractors for installation, the manufacturer shall guarantee and take responsibility for the workmanship of the certified subcontractor.

C. Manufacturer shall be Tank Connection Affiliate Group of Parsons, KS or Columbian TecTank of Lenexa, KS. The use of another manufacturer not listed herein requires prior approval by the

Engineer. Tank manufacturers and their production facilities must be headquartered in the United States. Manufacturer qualification information, as required in Specification 00421, shall be submitted with the Contractor'bid package.

D. The thermoset powder epoxy supplier and/or tank manufacturer shall certify that the recommended epoxy powder coating (and applied DFT) will withstand the leachate composition provided in Table A, and that this leachate storage application is appropriate for the coating. Thermoset powder coating must also be certified for "immersion" service. These certifications must be provided with the bid package as part of the qualification section.

E. The tank foundation designer shall be a Professional Engineer registered in the State of North Carolina with at least 5 years experience in the design of similar foundation systems.

F. The tank designer shall be a Professional Engineer registered in the State of North Carolina with at least 5 years experience in the design of similar tank structures.

1.03 SUBMITTALS

A. Submit, in accordance with Section 01300, shop drawings showing details of construction, erection, and coating information as follows:

1. Complete fabrication, assembly, support, and structural drawings together with design criteria, structural calculations, specifications, and data covering the materials and appurtenances to be furnished, dimensions of tanks, tank supports, piping, fittings and attachments. Drawings shall be signed and sealed by a licensed professional structural engineer registered in the state of North Carolina.

2. Material and performance information on the thermoset epoxy powder coating product to be used for interior and exterior coating. Submittal shall also include application and curing procedures.

2. Wall thicknesses (shell, head and base).

3. Locations of fittings, attachments and bolts.

4. Manufacturer's quality assurance/quality control document describing procedures to be followed during tank fabrication, and application and curing of coating. Instructions for handling, storage and installation of tanks shall also be provided.

5. Certification that fabrication is in accordance with these Specifications and AWWA D103.

6. Weight and center of gravity of tanks.

7. Seismic anchorage calculations. These calculations shall be completed and sealed by a professional civil engineer registered in the State of North Carolina.

8. Tank foundation and anchorage design calculation and detail drawings signed and sealed by a professional engineer registered in the State of North Carolina.

9. Shop testing and inspection procedures.

10. Shop testing and inspection report that includes mill test reports, mil thickness tests, and holiday detection tests for thermoset powder coating.

11. Provide the following information:

    a. Number of gallons per foot of depth.

    b. Total tank gallons.

    c. Usable gallons to the normal full level.

12. Resumes of job installation superintendent and field crew.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM A36 - Standard Specification for Carbon Structural Steel

2. ASTM A1011 Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

B. American Water Works Association (AWWA)

1. AWWA D103 Standard for Factory-Coated Bolted Steel Tanks for Water Storage

C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 DESIGN CRITERIA

A. The primary tank shall have a nominal diameter of approximately 33 feet and a nominal sidewall height (to roof eave) of approximately 28 feet. The secondary tank shall have a nominal diameter of approximately 71 feet and a nominal sidewall height of approximately 6.5 feet. Staircase access into the secondary containment area shall comply with all OSHA requirements.

B. The tank working capacity shall be not less than 150,000 gallons.

C. A minimum freeboard of 1-foot shall be provided for domed primary tank.

D. The materials, design, fabrication, and erection of the carbon steel bolted tank shall conform to the latest AWWA D103 standard for Factory-Coated Bolted Steel Tanks for Water Storage.

E. The thermoset epoxy powder coating and applied dry film thickness (DFT) shall be a fusion bonded epoxy coating that provides long-term corrosion resistance in a leachate storage (immersion) environment. Coating shall be compatible with the leachate composition provided in Table A of this specification.

F. The Contractor shall provide a shallow foundation system for the proposed tank with average bearing loads not exceed 1,850 pounds per square foot for dead and normal live loads. The allowable bearing capacity for the tank foundations shall be determined by the foundation designer based upon the subsurface conditions and the tank manufacturer's performance criteria (allowable settlement, etc.). Boring logs are provided in Appendix A and a geotechnical memorandum is available upon request. However, the Contractor's foundation designer shall remain responsible for the interpretation of subsurface conditions in preparation of the tank foundation design. Geotechnical design criteria shall be clearly indicated on the foundation drawings and in the associated engineering calculations.

1.06 DELIVERY, STORAGE AND HANDLING

A. All plates, members and miscellaneous parts shall be packaged for shipment in a manner that prevents abrasion or scratching of the finished coating system. Heavy paper or plastic foam sheets shall be placed between each panel to eliminate sheet-to-sheet abrasion.

B. Materials shall be delivered to the job site, marked for proper installation, as close to the time of erection as possible.

C. Individual stacks of panels shall be wrapped in heavy black plastic and shall be steel banded to special wood pallets built to the roll radius of the tank panels. The tank components shall be shipped from the factory to the job site by truck, and the truck that carries the tank components shall haul the tank components exclusively. The tank manufacturer shall be responsible for unloading all tank materials at the job site.

D. Handle and store all materials carefully to prevent distortions or other damage that could affect structural, mechanical, or electrical integrity. Store all materials that are subject to deterioration by exposure to the elements off the ground in a well-drained location and protected from the weather. All materials shall be accessible for inspection and handling.

E. Materials furnished for the tanks that are determined to be defective by the Engineer shall be rejected and replaced with acceptable sheets. All materials rejected must be removed from the project site immediately and replaced with material of a quality acceptable to the Engineer. Failure to reject any material or to require removal of any such rejected material shall not relieve the Contractor from responsibility for the quality and character of material used.

1.07 WARRANTY

The tank manufacturer shall provide a performance warranty on tank materials and workmanship for five (5) years. The warranty shall cover for defects in fabrication, installation, material, coating, appurtenances and workmanship during the warranty period.

PART 2 PRODUCTS

2.01 TANK

A. Plates and Sheets

1. Plates and sheets used in the construction of the tank shell, tank floor and tank roof, shall comply with the minimum standards of AWWA D103.

2. Design requirements for mild strength steel shall be ASTM A36 or ASTM A1011 Grade 30, 36, 40, or 50 with a maximum allowable tensile stress 18,000 psi.

3. Design requirements for high strength steel shall be ASTM A1011 Grade 42, 50, 55, or 60 with a maximum allowable tensile stress of 30,000 psi, unless otherwise noted in the engineering specifications and/or submittals.

B. Rolled Structural Shapes

1. Material shall conform to minimum standards of ASTM A36 or ANSI 1010.

C. Coating

1. Thermoset powder coating product shall be suitable for C&D leachate environment as discussed in paragraph 1.05. The coating shall be applied (to both the interior and exterior tank surfaces) with a precision electrostatic process to provide accurate control of coating thickness application.

2. Surface preparation shall be performed per tank and coating manufacturer's recommendations. At a minimum, sheets and tank components shall be blasted on both sides providing a surface profile of SSPC-SP10 near white blast. Anchor profile shall be 1.0 mil minimum. Sand blasting and chemical pickling of steel sheet is not acceptable.

3. Thermoset powder (polymer) coating for the tank interior and bottom shall be LIQ Fusion 7000 FBE by Tank Connections, Trico Bond EP by Columbian TecTank, or equivalent. Thermoset powder coating for the tank exterior prime coat shall be EXT Fusion 5000 FBE by Tank Connections, Trico Bond EP by Columbian TecTank, or equivalent. Exterior finish coat shall also be applied on top of the prime coat, and shall provide appropriate UV resistance. Field coating, except for touch up, will not be allowed for this project.

4. Interior tank coating shall be a minimum of 7.0 mils average DFT. Exterior prime and finish coat shall be a minimum of 6 mils DFT The thermoset powder coating shall be applied to all tank edges, in all bolt holes, and across all panels uniformly.

5. Thermoset epoxy powder coating curing procedures shall be performed in accordance with the tank and coating manufacturer's approved process. At a minimum, the oven curing process shall be a one-fire or two-fire process that provides a fusion-bonded solid coating resulting from the chemical cross-linking reaction. During the coating application process, the steel sheets and tank components shall be heated to the recommended epoxy powder application temperature. Curing temperature and times shall be in accordance with coating

manufacturer's recommendations. .

6. Interior and exterior coated surfaces shall be inspected for any visible defect or holiday, and coating thickness verified by a nondestructive mil-thickness test (Mikrotest or equal). Adhesion for interior and exterior coating shall be confirmed using 100 squares test. Interior coating inspection shall include a holiday detection test in accordance with AWWA D103 Section 12.9. Coated panels and tank parts shall be certified 100% factory holiday free prior to shipment. Exterior coating inspection shall occur prior to placement of finish coat.

D. Horizontal Wind Stiffeners

1. Web truss stiffeners shall be of steel with hot-dip galvanized coating.

2. Rolled steel angle stiffeners are not permitted for intermediate stiffeners.

E. Bolt Fasteners

1. Bolts used in tank lap joints shall be ½ - 13 UNC-2A rolled thread, and shall meet the minimum requirements of AWWA D103, Section 4.2.
2. Bolt Material
    a. SAE Grade 5 (1" thru 1½")

        Tensile strength – 105,000 psi Min.

        Proof Load – 74,000 psi Min.

    b. SAE Grade 8 (1" thru 11/2")

        Tensile Strength – 150,000 psi Min

        Proof Load – 120,000 psi Min.

3. Bolt Head Finish and Encapsulation
    c. Bolt finish shall be JS500 electro-plated, or zinc plated.
    d. High impact polypropylene copolymer encapsulation of entire bolt head up to the splines on the shank
    e. Resin shall be stabilized with an ultraviolet light resistant material such that the color shall appear black. The bolt head encapsulation shall be certified to meet the ANSI/NSF Standard 61 for indirect additives.
4. All bolts on the vertical tank wall shall be installed such that the head portion is located inside the tank, and the washer and nut are on the exterior.
5. Bolt lengths shall be sized to achieve a neat and uniform appearance. Excessive threads extending beyond the nut after torquing will not be permitted.

F. Sealants

1. The lap joint sealant shall be a one component, moisture cured, polyurethane compound.

The sealant shall be suitable for contact with leachate and shall be certified to meet ANSI/NSF Additives Standard 61 for indirect additives.

2. The sealant shall be used to seal lap joints and bolt connections and edge fillets for sheet notches and starter sheets. The sealant shall cure to a rubber-like consistency, have excellent adhesion to the thermoset powder epoxy coating, low shrinkage, and be suitable for interior and exterior use.
3. Sealant curing rate at 73°F and 50% RH
4. Tack-free time: 6 to 8 hours
5. Final cure time: 10 to 12 hours
6. Neoprene gaskets and tape type sealer shall not be used in leachate contacting surfaces.

2.02 TANK FLOOR

A. Steel Floor

1. The floor is to be a thermoset powder epoxy coated bolted steel floor. Bolted steel panels shall be placed over a concrete slab. Non-extruding and resilient bituminous type filler, meeting the requirements of ASTM D1751, should be placed between between the tank floor and concrete slab to act as a cushion.
2. A plastic encapsulated nut shall be used to cover the bolt threads exposed on the inside of the floor.

B. Embedded Base Setting Ring

1. The floor design is of reinforced concrete with an embedded thermoset powder epoxy coated steel starter sheet per the manufacturer's design and in accordance with AWWA D103, Sec. 13.4, and Type 6.
2. A leveling assembly shall be used to secure the started ring, prior to encasement to concrete. Installation of the starter ring on concrete blocks or bricks, using shims for adjustment, is not permitted.
3. Leveling the starter ring shall be required and the maximum differential elevation within the ring shall not exceed one-eighth (1/8) inch, nor exceed one-sixteenth (1/16) inch within any ten (10) feet of length.
4. Place one butyl rubber elastomer waterstop seal strip on the inside surface of the starter ring below concrete floor line. Place one Conseal CS-231impregnated water seal below the butyl rubber seal. Install materials in accordance with tank manufacturer's instructions.

C. Sidewall Structure

1. Field erection of the thermoset powder epoxy coated bolted steel tank shall be in strict accordance with the procedures outlined by the manufacturer, using factory trained erectors.
2. Particular care shall be taken in handling and bolting of the tank panels and members to avoid abrasion of the coating system. Prior to a liquid test, the Engineer may visually inspect all surface areas.

3. An electrical leak test shall be performed during erection using a wet sponge low voltage leak detection device. All electrical leak points found on the inside surface shall be repaired in accordance with manufacturer's published touch up procedures.
4. The placement of sealant on each panel may be inspected prior to placement of adjacent panels. However, the Engineer's inspection shall not relieve the contractor from his responsibility for liquid tightness.
5. No backfill shall be placed against the tank sidewall without prior written approval and design review of the tank manufacturer. Any backfill shall be placed according to the strict instructions of the tank manufacturer.

D. Thermoset Powder Epoxy Coated Steel Deck Roof

Tank shall include a sectioned roof fabricated from thermoset powder epoxy coated, bolted steel panels as fabricated by the tank manufacturer, and shall be assembled in a similar manner as the sidewall panels utilizing the same sealant and bolt installation techniques. The roof shall be clear-span and self-supporting or center supported. Both live and dead loads shall be carried by the tank walls and any center supports.

E. Roof Vent

A properly sized vent assembly in accordance with AWWA D103 shall be furnished and installed above the maximum water level of sufficient capacity so that at maximum design rate of water fill or withdrawal, the resulting interior design pressure / vacuum will not exceed +2.0 / -0.5 ounces per square inch.

The overflow pipe shall not be considered to be a tank vent. The vent shall be so designed in construction as to prevent the entrance of birds and/or animals by including a 16 mesh (1/16" opening size) galvanized screen installed to prevent the entrance of insects.

F. Appurtenances

1. Pipe Connections
    a. Overflow piping shall be minimum 4 inches nominal diameter schedule 10 carbon steel coated externally. A 90 degree internal weir elbow with external downcomer pipe and flap valve shall be provided for the overflow.
    b. Inlet and outlet connections shall conform to the sizes and locations specified on the Drawings.
2. Outside Tank Ladder
    a. An outside tank ladder shall be furnished and installed.
    b. Safety cage and step-off platforms shall be fabricated of galvanized steel. Ladders shall be equipped with a hinged lockable entry device.
3. Access Doors
    a. One manway shall be provided in accordance with AWWA D103.
    b. The manhole opening shall be a minimum of 24 inches in diameter. The access

door (shell manhole) and the tank shell reinforcing shall comply with AWWA D103, Sec. 7.1.

4. Liquid Level Indicator

    a. A liquid level indicator with stainless steel float, number board, and high visibility target shall be provided and installed as detailed on the project drawings.

5. Identification Plate

    a. A manufacturer's nameplate shall list the tank serial number, tank diameter and height, and maximum design capacity. The nameplate shall be affixed to the tank exterior sidewall location approximately five (5) feet from the grade elevation.

6. Leachate Transfer Pumps and panels

    a. The manufacturer shall furnish leachate transfer pumps with complete piping, control panels and valves as shown on the Drawings. Refer to Section 11311.

7. Electrical (Refer to Division 16).

PART 3 INSTALLATION

3.01 INSTALLATION PROCESS

A. Field erection of the bolted steel tank will be in strict accordance with manufacturing procedures using factor trained and certified erectors.

B. Particular care will be taken to protect the panels and coating from damage (i.e., scratches, abrasion) during field installation.

C. Tank to be constructed utilizing synchronized (hydraulic screw) jacking process, which keeps construction crews at grade level for safety and point access quality control. Any coating damage will be repaired per manufacturer's recommendations.

D. No backfill shall be placed against the tank sidewall during or after the construction process.

E. Foundations

1. The foundation system shall be installed in accordance with the recommendations provided by the tank manufacturer or Contractor's foundation designer. The foundation designer or a suitable representative shall be present at the commencement of installation of the foundation system and as needed throughout installation to verify the applicable design assumptions and installation recommendations.

2. Subgrade and excavation for foundation shall be inspected by the manufacturer's or Contractor's geotechnical engineer prior to foundation construction.

3. The Contractor shall exercise care to avoid disturbance of excavated subgrade prior to placement of structural fill or concrete foundations. Refer to Division 2, Earthwork, for protection of subgrade.

3.02 FIELD TESTING

A. Following completion of erecting and cleaning of the tank, the structure shall be tested for liquid tightness by filling tank to its overflow elevation.

B. The contractor in accordance with the manufacturer's recommendations shall correct any leaks disclosed by this test.

C. The Contractor shall furnish water required for testing at the time of tank erection completion, and at no charge to the Owner. Disposal of test water shall be the responsibility of the Contractor.

D. During erection of the tank, the manufacturer shall perform mil thickness test (Mikrotest or equal) and a holiday detection test (tinker Rasor or equal) of fusion bonded epoxy coating. Any defects identified by these tests shall be corrected to the satisfaction of the Engineer. A report shall be submitted to the Engineer summarizing the results of the test and any repairs made.

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Table A: Example of Construction and Demolition (C&D) Landfill Leachate Composition

Parameters	Unit	Concentration
PH	-	6.1 – 9.0
TDS	mg/L	780 – 7,040
Chloride	mg/L	6.8 – 1,180
Sulfate	mg/L	41- 8,570
Nitrogen, Ammonia	Mg/L	0.053 – 92.1
Calcium	mg/L	106 – 933
NPOC	mg/L	1.1 – 80.5
Arsenic	µg/L	<5.0 – 147.8
Manganese	µg/L	6.0 – 74.9
Copper	µg/L	5.6 – 1,740
Iron	mg/L	0.3 – 4.6
Manganese	mg/L	0.2 – 2.3
Nickel	mg/L	<500
Zinc	mg/L	107 – 1,731

References:

1. Timothy G. Townsend and al., "*Continued Research into the characteristics of leachate from construction and demolition waste landfills*" July 2000, State University System of Florida Report #00-04
2. State of Ohio EPA Draft study, " A Comparison of Selected Parameters from Ohio Construction and Demolition Debris Leachate with Ohio Municipal Solid Waste Leachate" June 12, 2009.

END OF SECTION

SECTION 13341

INSTRUMENTATION AND CONTROLS – FLOW DEVICES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This section covers the furnishing, installation, and services for the flow related instruments.

B. Auxiliary and accessory devices necessary for system operation or performance, such as transducers, relays, signal amplifiers, intrinsic safety barriers, signal isolators, software, and drivers to interface with existing equipment or equipment provided by others under other Sections of these specifications, shall be included whether they are shown on the Drawings or not.

C. Substitutions on functions or type of equipment specified shall not be acceptable unless specifically noted. In order to confirm compatibility between all equipment, coordinate all interface requirements with mechanical and electrical systems and furnish any signal isolation devices that might be required.

D. Equipment shall be fabricated, assembled, installed and placed in operating condition in full conformity with the project Specifications, Drawings, engineering data, instructions, and recommendations of the equipment manufacturer as approved by the Engineer.

E. To facilitate the Owner's future operation and maintenance, similar products (e.g., flow element and transmitter) shall be supplied from the same manufacturer.

F. All equipment and installations shall satisfy applicable Federal, State and local codes.

1.02 ACCESSORIES

A. All mounting hardware required for pipe stand, surface, or other mounting shall be provided.

B. Each instrument shall be provided with a manufacturer installed stainless steel tag identifying the instrument tag number.

1.03 WARRANTY

A. Refer to Section 01740.

1.04 APPROVALS/CERTIFICATIONS

A. Instruments specified herein shall meet at a minimum, the National Electrical Manufacturers Association (NEMA) rating for non-hazardous locations listed with each instrument. Those instruments that are submerged in a liquid or are located in submersible area shall also meet NEMA 6 ratings approval. All instruments that are located in hazardous areas as indicated on the Electrical Classification

Drawings or in the Instrument Device Schedule shall meet the Factory Mutual (FM), Canadian Standards Association (CSA), and CENELEC Class, Division and Group approvals and certifications listed for that area. The instrument shall have a stainless steel tag identifying the relevant approval or certification

PART 2 PRODUCTS

2.01 Magnetic Flowmeter (integral)

A. Flow Element

1. Type:

a. Type: Pulsed DC type induction type and shall provide a signal which is linear to the liquid flow rate.

2. Function/Performance:

a. Operating Temperature: Process liquid temperatures of 0 to 140 degrees F or greater dependent upon liner and an ambient of minus 30 to 150 degrees F.

b. Power requirements: Match to converter/transmitter

c. Accuracy: Plus or minus 0.2 percent of reading, or +/- 1 millimeter per second, whichever is greater, irrespective of flow direction (including converter/transmitter).

d. Radio Frequency Interference (RFI) protection: RFI protection shall be provided as recommended by the manufacturer.

e. Pressure rating: Equal to piping system where meter is installed.

f. Additional: Meter shall be capable of running empty indefinitely without damage to any component.

3. Physical:

a. Metering Tube: 304 stainless steel or equivalent.

b. Flanges: ANSI 150 lb. or DIN PN 16 carbon steel, as required by the piping system, unless otherwise indicated. ANSI 150 lb. or DIN PN 16 stainless steel flanges shall be used on all SS process pipes.

c. Liner shall be chemically resistant to leachate.

d. Electrodes: 316 stainless steel standard minimum requirements. All electrodes to be compatible with process fluid.

e. For sludge, polymer, or any slurry application where the electrodes will be coated, a self cleaning or a removable electrode option must be provided with that meter.

f. Housing: Meters shall be NEMA 4X (IP65). Where hazardous areas are indicated on the Drawings, the equipment shall be rated for that area.

g. Meter shall be designed for outdoor use.

h. Finish: All external surfaces shall have a chemical and corrosion resistant finish.

4. Power Requirements:

a. Meter shall be 24 VDC powered instrument, receiving its power from integral transmitter.

5. Accessories/Documentation Required:

a. Factory calibration: All meters shall be factory calibrated. A copy of the report shall be included in the O&M manual.

b. Grounding: Meter shall be grounded in accordance with the manufacturer's recommendation. Provide ground ring, ground wires, gaskets, etc., as required. All materials shall be suitable for the liquid being measured and must be compatible with process fluid and with the process pipe.

B. Flow Converter/Transmitter

1. Type:

a. Micro processor based, intelligent transmitter shall be mounted integral and on top of the meter.

b. Type: Match to flow element

2. Functional/Performance:

a. Accuracy (including flowtube): As defined for flow element.

b. Operating Temperature: –20 to 140 degrees F.

c. Output: Isolated 4-20 mA with HART protocol. Current output adjustable over the full range of the instrument. A dry contact rated for 120 VAC, 2A to indicate reverse flow.

d. Diagnostics: Self diagnostics with on screen display of faults.

e. Display: Digital indicator displaying flow in engineering units indicated in the Instrument Device Schedule.

f. Totalizer: A fully configurable totalizer integral to the transmitter. Totalized flow shall be displayed.

g. Empty Tube Zero: The transmitter shall include a feature that will lock

the output at zero when no flow is detected. The empty tube zero feature shall be enabled automatically when the transmitter detects no flow or manually through a contact input.

h. Provide electrode cleaning unit to match flow element requirements.

3. Physical:

a. Enclosure shall be NEMA 4X (IP65). Where hazardous areas are indicated on the Drawings, the equipment shall be rated for that area.

b. Transmitter to be integral to meter.

4. Power Requirements:

a. The transmitter shall be 120 VAC powered instrument.

5. Accessories/ Required:

a. Keypad or remote device where required for transmitter configuration depending upon area classification.

C. Manufacturer(s):

1. Siemens Sitrans MAGFLO FM Integral Series.

2. Endress+Hauser Proline Promag 10W

3. ABB Instruments MagMaster Integral Series.

4. Rosemount Series 8732 Meter/Transmitter.

D. UNITS TO BE SUPPLIED

1. FE/FIT 1 (Primary):

a. Line Size: 2-inch

b. Flow Range: 0-180 gpm

2. FE/FIT 2 (Secondary):

a. Line Size: 1-inch

b. Flow Range: 0-20 gpm

PART 3 EXECUTION

3.01 GENERAL

A. Instrumentation and accessory equipment shall be installed in accordance with the manufacturer's instructions. The locations of equipment, transmitters and similar

devices indicated are approximate only. Exact locations of all devices shall be as approved by the Engineer during construction. Obtain in the field, all information relevant to the placing of process control equipment and in case of any interference with other work, proceed as directed by the Contractor and furnish all labor and materials necessary to complete the work in an approved manner at no additional cost to the Owner.

B. The secondary leachate flow meter shall be located along the line such that the minimum straight pipe run in and out of the meter per the manufacturer's recommendation is met.

C. All equipment used in areas designated as hazardous shall be designed for the Class, Group and Division as required for the locations as shown on the Drawings. All work shall be in strict accordance with codes and local rulings.

D. Unless specifically indicated, direct reading or electrical transmitting instrumentation shall not be mounted on process piping. Instrumentation shall be mounted on instrument racks or stands. All instrumentation connections shall be provided with shutoff and drain valves. For differential pressure transmitters, 5-valve manifolds for calibration, testing and blow down service shall also be provided. For chemical or corrosive fluids, diaphragm seals with flushing connections shall be provided.

E. All piping and tubing to and from field instrumentation shall be provided with necessary unions, calibrations and test tees, couplings, adaptors, and shut-off valves. Process tubing shall be installed to slope from the instrument toward process for gas measurement service and from the process toward the instrument for liquid measurement service. Provide drain/vent valves or fittings at any process tubing points where the required slopes cannot be maintained.

F. Brackets and hangers required for mounting of equipment shall be provided. They shall be installed as shown and not interfere with any other equipment.

G. The shield on each process instrumentation cable shall be continuous from source to destination and be grounded at only one ground point for each shield.

H. Investigate each space in the building through which equipment must pass to reach its final location. If necessary, ship material in sections sized to permit passing through restricted areas in the building. Provide on-site service to oversee the installation, the placing and location of system components, their connections to the process equipment panels, cabinets and devices, subject to the Engineer's approval. Certify that field wiring associated with his/her equipment is installed in accordance with best industry practice. Schedule and coordinate work under this section with that of the electrical work specified under applicable Sections of Division 16.

END OF SECTION

SECTION 15100

VALVES AND APPURTENANCES

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and incidentals required, and install complete and ready for operation, all valves and appurtenances as shown on the Drawings and as specified herein.

B. The equipment shall include, but not be limited to, the following:

1. Ball valves
2. Check valves
3. Combination Air valves
4. Gate valves

1.02 RELATED WORK

A. Earthwork is included in Division 2.

B. Piping is included in the respective Sections of Divisions 2.

C. Electrical is included in Division 16.

1.03 SUBMITTALS

A. Copies of all materials required to establish compliance with these Specifications shall be submitted in accordance with the provisions of Section 01300. Submittals shall include at least the following:

1. Certified drawings showing all important details of construction and dimensions.
2. Descriptive literature, bulletins, and/or catalogs of the equipment.
3. The total weight of each item.
4. A complete total bill of materials.
5. A list of the manufacturer's recommended spare parts.
6. Any other information required by Section 01300.

B. Operation and Maintenance Data

1. Operating and maintenance instructions shall be furnished to the Engineer as provided in Section 01170. The instructions shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions, etc., that are required to instruct operating and maintenance personnel unfamiliar with such equipment.

1.04 REFERENCE STANDARDS

A. Where reference is made to standards, the revision in effect at the time of the bid opening shall apply.

1.05 QUALITY ASSURANCE

A. All of the types of valves and appurtenances shall be products of well-established firms who are fully experienced, reputable and qualified in the manufacture of the particular equipment to be furnished. The equipment shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these specifications as applicable.

1.06 SYSTEM DESCRIPTION

A. All of the equipment and materials specified herein is intended to be standard for use in controlling the flow of landfill leachate.

1.07 MAINTENANCE

A. Special Tools

1. Special tools for normal operation and maintenance shall be supplied with the equipment.

1.08 WARRANTY

PART 2: PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. General

1. All valves and appurtenances shall be of the size shown on the Drawings and as far as possible all equipment of the same type shall be from one manufacturer.

2. All valves and appurtenances shall have the name of the maker, flow directional arrows and the working pressure for which they are designed cast in raised letters upon some appropriate part of the body.

3. Insofar as possible, all valves shall open counter clockwise.

4. All valves to be buried shall be specially constructed for buried service

2.02 VALVES

A. Ball Valves

1. Ball valves shall be of PVC Type 1 with flanged ends and full-port opening. PVC ball valves shall be as manufactured by Chemtrol, Asahi/America, or equal. All valves shall be mounted in such a position that valve position indicators are plainly visible. Provide quarter-turn manual valve operator and valve seat adjustability.

B. Check Valves

1. Swing check valves shall be of PVC Type 1, flanged ends, full ported with top entry access for disc inspection and removal. Furnish with outside lever and weight, with weight position along lever arm adjustable. PVC ball check valves shall be as manufactured by Chemtrol, Asahi/America, or equal.

C. Combination Air Valves

1. Combination Air valves shall be Apco Model No. 145C, 2 - inch with 3/32 inch outlet orifice.

2. Valves shall be single body cast iron construction, with stainless steel floats, bronze plug and Buna-N seats, as manufactured by Apco Valve and Primer Corporation, or equal.

D. Gate Valve

1. Gate valves shall be of PVC Type 1 as manufactured by Chemtrol, ASAHI/America, or equal.

E. Operating Floor Stands

1. Operating floor stands shall be furnished and installed as indicated on the Drawings. They shall be heavy-pattern type, and shall be adequate and suitable for the type, weight, and operating pressures of the valves furnished. Floor stands shall be Type A-26426 as manufactured by Mueller Co. or approved equal.

2. Extension mechanisms shall be furnished and installed. Operating floor stands and extensions shall be of the same manufacture as the valves they will operate.

F. VALVE ACTUATOR

1. The electric valve actuator shall consist of a high torque reversible motor, self-locking reduction gearing, end of stroke limit switches, mechanical torque sensing switch, a declutchable handwheel device, end of stroke adjustable mechanical stops, all as a self-

contained unit. Controller shall modulate valve position based on a 4-20mA input signal. Actuator shall be Limitorque Model LY series or approved equal.

2. The actuator shall be sized and selected against valve operating torque values and safety factors stated by the valve manufacturer. The sizing shall be based on the maximum torque encountered during the stoke of the valve(s) when operating under maximum working conditions.

3. The output of the actuator shall be of hollow bored design supplied with a bushing adapter suitable for removal and machining by the valve manufacturer, in order to insure proper fit with the valve stem.

4. The actuator enclosure shall be of cast aluminum construction designed to meet NEMA 7 explosion-proof requirements suitable for Class 1, Groups D, Division 1 locations.

5. The motor shall be reversible and be of the permanent split capacitor type designed for 120 volts, 1 phase, 60 HZ supply. Motor insulation shall be Class •B• and be suitable for 15 minutes duty operation. Motor bearings shall be of the permanently sealed type.

6. The actuator shall be suitable for operating in ambient temperatures for - 20 degrees F to +150 degrees F.

7. The actuator shall be a double reduction unit consisting of a self-locking worm gear drive suitable for maintaining valve position in the event of electric power failure. The worm shall be hardened alloy steel and the worm gear shall be of alloy bronze. All power gearing shall be grease lubricated.

8. A travel limit switch shall be provided for each direction of travel. Provision shall be made for auxiliary switches capable of being set to operate for any point of travel. Switches shall be S.P.D.T., snap action type, totally enclosed and rated for 120 VAC service. Switches shall be operated by cams arranged in a stack on a single shaft with one hex locking nut to insure that cams do not slip once properly adjusted. Arrangement shall be as simple as possible. No special tools shall be required for adjustments.

9. The actuator shall be equipped with a double acting torque switch which is to be responsive to loads encountered in either the opening or closing direction. The torque switch shall operate during the complete valve cycle without the use of auxiliary relays, linkages, latches, or other devices. The torque switch shall be wired to shut off the actuator motor in the event excessive loads are encountered during travel.

10. A handwheel shall be provided for manual operation and for use during limit switch adjustment and when adjusting mechanical end of travel stops. The handwheel shall not rotate during motor operation, nor shall a fused motor prevent manual operation. When in manual operating position, the unit will remain in this position until motor is energized at which time the valve actuator will automatically return to electric operating and shall remain in motor operation until handwheel operation is desired. This movement from

motor operation to handwheel operation shall be accomplished by a positive declutching lever which will disengage the motor and motor gearing mechanically, but not electrically.

11. The actuator shall be supplied with local visual indication of valve position.

12. Actuator shall be grease lubricated and capable of being mounted in any position.

2.03 VALVE BOXES

A. All gate, butterfly and plug valves shall be provided with extension shafts, operating nuts and valve boxes as follows:

1. Extension shafts shall be Type 304 stainless steel and the operating nut shall be 2-in square. Shafts shall be designed to provide a factor of safety of not less than four. Operating nuts shall be pinned to the shafts.

2. Top of the operating nut shall be located 2-in below the rim of the valve box.

3. Valve boxes shall be as manufactured by Chemtrol, Asahi/America or equal and shall be a heavy-pattern cast iron, three-piece, telescoping type box with dome base suitable for installation on the buried valves. Inside diameter shall be at least 4-1/2-in. Barrel length shall be adapted to the depth of cover, with a lap of at least 6-in when in the most extended position. Covers shall be cast iron with integrally-cast direction-to- open arrow. Aluminum or plastic are not acceptable. A means of lateral support for the valve extension shafts shall be provided in the top portion of the valve box.

4. The upper section of each box shall have a top flange of sufficient bearing area to prevent settling. The bottom of the lower section shall enclose the stuffing box and operating nut of the valve and shall be oval.

5. An approved operating key or wrench shall be furnished.

6. All fasteners shall be Type 304 stainless steel.

2.04 HYDRANTS (NOT USED)

PART 3: EXECUTION

3.01 INSTALLATION

A. All valves and appurtenances shall be installed in the locations shown, true to alignment and rigidly supported. Any damage to the above items shall be repaired to the satisfaction of the Engineer before they are installed.

B. Install all brackets, extension rods, guides, and appurtenances as shown on the Drawings that are in masonry floors or walls, and install concrete inserts for hangers and supports.

C. All materials shall be carefully inspected for defects in workmanship and materials; all debris and foreign material cleaned out of valve openings, etc; all operating mechanisms operated to check their proper functioning and all nuts and bolts checked for tightness. Valves and other equipment which do not operate easily, or are otherwise defective, shall be repaired or replaced at no additional cost to the Owner.

3.02 INSTALLATION OF BURIED VALVES AND VALVE BOXES

A. Buried valves shall be cleaned and manually operated before installation. Buried valves and valve boxes shall be set with the stem vertically aligned in the center of the valve box. Valves shall be set on a firm foundation and supported by tamping pipe bedding material under the sides of the valve. The valve box shall be supported during backfilling and maintained in vertical alignment with the top flush with finish grade. The valve box shall be set so as not to transmit traffic loads to the valve.

B. Before backfilling, all exposed portions of any bolts shall be coated with two coats of bituminous paint.

C. Install valve floorstand operators with stainless steel bolts.

3.03 INSTALLATION OF HYDRANTS (NOT USED)

3.04 INSPECTION AND TESTING

A. The various pipe lines in which the valves and appurtenances are to be installed are specified to be field tested. During these tests any defective valve or appurtenance shall be adjusted, removed and replaced, or otherwise made acceptable to the Engineer.

B. After installation, all valves and appurtenances shall be tested at least 1 hour at the working pressure corresponding to the class of pipe, unless a different test pressure is specified. If any joint proves to be defective, it shall be repaired to the satisfaction of the Engineer.

END OF SECTION

SECTION 16000

ELECTRICAL - GENERAL PROVISIONS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install complete and make operational, electrical and process instrumentation systems as shown on the drawings and specified herein at the Cabarrus County "Cabarrus County C&D Landfill".

B. The work shall include furnishing, installing and testing the equipment and materials specified in other Sections of the Division 16 Specifications and shown on the Drawings.

C. The work shall include furnishing and installing the following:

1. Switchboards, Motor Control Centers, Weatherproof Enclosures, Variable Frequency Drives, Reduced Voltage Auto Transformer Starters, Boxes, Panelboards and Transformers.

2. Conduit, wire and field connections for all motors, motor controllers, control devices, control panels and electrical equipment furnished under other Divisions of these specifications.

3. Conduit, wiring and terminations for all field-mounted instruments furnished under other Divisions of these specifications, including process instrumentation primary elements, transmitters, local indicators and control panels. Lightning and surge protection equipment wiring at process instrumentation transmitters. Install vendor furnished cables specified under other Divisions of these specifications.

4. Conduit, wiring and terminations for variable frequency drives, harmonic filters, motor control centers, transformers and power factor correction capacitors furnished under other Divisions of these specifications.

5. Power wiring for all heating, ventilating, and air conditioning (HVAC) equipment furnished under other Divisions of these Specifications, including power wiring as shown on drawings for unit heater motors, thermostats, fan motors, dampers and other HVAC inline unit wiring shown on the Drawings.

6. Furnish and install precast manholes, precast handholes and light pole bases.

7. Furnish and install manhole and handhole frames and covers.

8. It is the intent of these Specifications that the electrical system shall be suitable in every way for the service required. All material and all work which may be reasonably implied as being incidental to the work of this Section shall be furnished at no extra cost.

9. Modifications to existing control systems including installation of auxiliary motor starter contacts, relays, switches, etc, as required to provide the control functions or inputs as shown on the Drawings. Obtain the existing equipment shop drawings from the Owner before attempting to make any modifications to the existing equipment wiring. Verify all existing wiring and connections for correctness. If record drawings are not available, trace

all circuits in the field and develop the wiring diagrams necessary for completion of the work. Document all changes made to the wiring diagrams and return a marked-up set of Record Drawings to the Owner after the work is complete.

10. Modifications to existing motor control centers, switchboards, panelboards and motor controllers including installation of circuit breakers, etc, or disconnection of circuits as required to provide the power supplies to new and existing equipment to maintain the facility in operation.

D. All power interruptions to electrical equipment shall be at the Owner's convenience with 72 hours (minimum) notice. Each interruption shall have prior approval.

E. The Contractor shall maintain existing facility in operation at all times. Temporary power connections as required shall be provided by the Contractor at no additional expense to the Owner. All temporary wiring shall be in accordance with the NEC. Any temporary equipment feeders (120V, 208V, 240V, 480V) shall be installed in conduit. The Contractor shall provide to the Engineer details, methods, materials etc. prior to making temporary connections. Furnish and install all equipment and materials including control equipment, motor starters, branch and feeder circuit breakers, panelboards, transformers, etc., for temporary power.

F. Field verify all existing underground electrical conduit, concrete duct banks, manhole, pull boxes, etc. and mechanical piping. The Contractor shall include in his bid all cost associated with relocation or removal of underground equipment as required for construction of the new facilities.

G. The Contractor shall prepare and furnish electrical and instrumentation conduit layout shop drawings for yard electrical, within and under all roads, buildings and structures to the Engineer for approval prior to commencing work. Layouts shall include but not be limited to equipment, pull boxes, manholes, conduit routing, dimensioning, methods and locations of supports, reinforcing, encasement, materials, conduit sizing, equipment access, potential conflicts, building and yard lighting, and all other pertinent technical specifications for all electrical and instrumentation conduits and equipment to be furnished. All layouts shall be drawn to scale on 24 x 36 sheets. Refer to Division 16000, 1.03, H for additional requirements.

H. The work shall include complete testing of all equipment and wiring at the completion of work and making any minor correction changes or adjustments necessary for the proper functioning of the system and equipment. All workmanship shall be of the highest quality; substandard work will be rejected.

I. A single manufacturer shall provide switchboard, motor control centers, transformers, reduced voltage solid state starters, variable frequency drives, disconnect switches, bus duct, panel boards, etc. This manufacturer shall also provide a short circuit/coordination study as specified herein.

J. Contractor shall provide their own temporary power for miscellaneous power (drills, pumps, etc.). No facility circuits shall be used unless approved in writing by the Engineer. Any temporary added shall be removed at job completion.

K. Complete coordination with other contractors. Contractor shall coordinate with all other contractors equipment submittals and obtain all relevant submittals.

L. Mount transmitters, process instruments, operators stations, etc. furnished under other Divisions of these specifications.

M. Concrete electrical duct encasement, including but not limited to excavation, concrete, conduit, reinforcement, backfilling, grading and seeding is included in Division 16. All work shall be done in accordance with Divisions 2 and 3 of these specifications.

N. Excavation, bedding material, forms, concrete and backfill for underground raceways; forms and concrete for electrical equipment furnished herein is included in Division 16. All work shall be done in accordance with Divisions 2 and 3 of these specifications.

O. The contractor shall include in the base bid the following miscellaneous wiring, including installation costs. (Assume all conduit to be exposed at elevations up to 20 feet and include all necessary pullboxes, supports, etc.):

1. 3,000 feet of 4 No. 12 – ¾ inch Rigid Aluminum conduit

2. 3,000 feet of 2 No. 14 – ¾ inch Rigid Aluminum conduit

3. 1,000 feet of 2/C No. 16 shielded – ¾ inch Rigid Aluminum conduit

1.02 RELATED REQUIREMENTS

A. Excavation and backfilling, including gravel or sand bedding for underground electrical work is specified in Division 2.

B. Cast in place concrete work, including concrete encasements for electrical duct banks, equipment pads, light pole bases and reinforcing steel, is specified in Division 3.

1.03 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01300 for approval by the Owner, shop drawings for equipment, materials and other items furnished under Division 16.

B. Shop drawings shall be submitted for the following equipment:

1. Raceways, Boxes, Fittings and Hangers

2. Bus Duct

3. Wires and Cables

4. Miscellaneous Equipment (as specified in Section 16191)

5. Switchboards

6. Panelboards

7. Motor Control Centers

8. Reduced Voltage Solid State Starters

9. Lighting Fixtures and Lamps

10. Switches, Receptacles and Covers

11. Lightning Protection System

12. Precast Manholes and Handholes, Frames and Covers

13. Grounding Hardware and Connections

14. Security Alarm System

15. Pullboxes

C. The Manufacturers name and product designation or catalog numbers shall be submitted for the following material utilized:

1. Testing Equipment

2. Ground System Resistance Test Equipment

D. Check shop drawings for accuracy and contract requirements prior to submittal. Shop drawings shall be stamped with the date checked and a statement indicating that the shop drawings conform the Specifications and the Drawings. This statement shall also list all exceptions to the Specifications and the Drawings. Shop drawings not so checked and noted shall be returned.

E. The Engineer's check shall be for conformance with the design concept of the project and compliance with the Specifications and the Drawings. Errors and omissions on approved shop drawings shall not relieve the Contractor from the responsibility of providing materials and workmanship required by the Specifications and the Drawings.

F. All dimensions shall be field verified at the job site and coordinated with the work of all other trades.

G. Material shall not be ordered or shipped until the shop drawings have been approved. No material shall be ordered or shop work started if shop drawings are marked "APPROVED AS NOTED - CONFIRM", "APPROVED AS NOTED - RESUBMIT" or "NOT APPROVED".

H. In addition to Manufacturer's equipment shop drawings, submit electrical installation working drawings containing the following:

1. Concealed and buried conduit layouts, shown on floor plans drawn at not less than 1/4-in = 1-ft-0-in scale. The layouts shall include locations of process equipment, motor control centers, transformers, panelboards, control panels and equipment, motors, switches, motor starters, large junction or pull boxes, instruments and any other electrical devices connected to concealed or buried conduits.

2. Plans shall be drawn on high quality reproducible, double sided mylar, size 36-in by 24-in and shall be presented in a neat, professional manner.

3. Concrete floors and/or walls containing concealed conduits shall not be poured until conduit layouts are approved.

4. Layout drawings shall be drawn utilizing approved equipment submittals.

I. Operation and Maintenance Data

1. Submit operations and maintenance data for equipment furnished under this Division, in accordance with Section 01730. The manuals shall be prepared specifically for this installation and shall include catalog data sheets, drawings, equipment lists, descriptions, parts lists, etc, to instruct operating and maintenance personnel unfamiliar with such equipment.

2. Manuals shall include the following as a minimum:

   a. A comprehensive index.

   b. A complete "As-Built" set of approved shop drawings.

   c. A complete list of the equipment supplied, including serial numbers, ranges and pertinent data.

   d. A table listing of the "as left" settings for all timing relays and alarm and trip setpoints.

   e. System schematic drawings "As-Built", illustrating all components, piping and electric connections of the systems supplied under this Section.

   f. Detailed service, maintenance and operation instructions for each item supplied.

   g. Special maintenance requirements particular to this system shall be clearly defined, along with special calibration and test procedures.

   h. The operating instructions shall also incorporate a functional description of the entire system, with references to the systems schematic drawings and instructions.

   i. Complete parts list with stock numbers, including spare parts.

1.04 REFERENCE STANDARDS

A. Electric equipment, materials and installation shall comply with the latest edition of National Electrical Code (NEC) and with the latest edition of the following codes and standards:

1. National Electrical Safety Code (NESC)

2. Occupational Safety and Health Administration (OSHA)

3. National Fire Protection Association (NFPA)

4. National Electrical Manufacturers Association (NEMA)

5. American National Standards Institute (ANSI)

6. Insulated Cable Engineers Association (ICEA)

7. Instrument Society of America (ISA)

8. Underwriters Laboratories (UL)

9. Factory Mutual (FM)

10. International Electrical Testing Association (NETA)

11. Institute of Electrical and Electronic Engineers (IEEE)

B. All electrical equipment and materials shall be listed by Underwriter's Laboratories, Inc., and shall bear the appropriate UL listing mark or classification marking. Equipment, materials, etc. utilized not bearing a UL certification shall be field or factory UL certified prior to equipment acceptance and use.

C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 PRIORITY OF THE CONTRACT DOCUMENTS

A. If, during the performance of the work, the Contractor finds a conflict, error or discrepancy between or among one or more of the Sections or between or among one or more Sections and the Drawings, furnish the higher performance requirements. The higher performance requirement shall be considered the equipment, material, device or installation method which represents the most stringent option, the highest quality or the largest quantity.

B. In all cases, figured dimensions shall govern over scaled dimensions, but work not dimensioned shall be as directed by the Engineer and work not particularly shown, identified, sized, or located shall be the same as similar work that is shown or specified.

C. Detailed Drawings shall govern over general drawings, larger scale Drawings take precedence over smaller scale Drawings, Change Order Drawings shall govern over Contract Drawings and Contract Drawings shall govern over Shop Drawings.

D. If the issue of priority is due to a conflict or discrepancy between the provisions of the Contract Documents and any referenced standard, or code of any technical society, organization or association, the provisions of the Contract Documents will take precedence if they are more stringent or presumptively cause a higher level of performance. If there is any conflict or discrepancy between standard specifications, or codes of any technical society, organization or association, or between Laws and Regulations, the higher performance requirement shall be binding on the Contractor, unless otherwise directed by the Engineer.

E. In accordance with the intent of the Contract Documents, the Contractor accepts the fact that compliance with the priority order specified shall not justify an increase in Contract Price or an extension in Contract Time nor limit in any way, the Contractor's responsibility to comply with all Laws and Regulations at all times.

1.06 ENCLOSURE TYPES

A. Unless otherwise specified herein or shown on the Drawings, electrical enclosures shall have the following ratings:

1. NEMA 1 for dry, non-process indoor locations.

2. NEMA 12 for "DUST" locations.

3. NEMA 4X for outdoor locations, rooms below grade (including basements and buried vaults), "DAMP" and "WET" locations.

4. NEMA 4X for "CORROSIVE" locations.

5. NEMA 7 (and listed for use in the area classifications shown) for "Class I Division 1 Group D", "Class I Division 2 Group D" and "Class II Division 1" hazardous locations shown on the Drawings.

1.07 HAZARDOUS AREAS

A. Equipment, materials and installation in areas designated as hazardous on the Drawings shall comply with NEC Articles 500, 501, 502 and 503.

B. Equipment and materials installed in hazardous areas shall be UL listed for the appropriate hazardous area classification.

1.08 CODES, INSPECTION AND FEES

A. Equipment, materials and installation shall comply with the requirements of the local authority having jurisdiction.

B. Obtain all necessary permits and pay all fees required for permits and inspections.

1.09 TESTS AND SETTINGS

A. Test systems and equipment furnished under Division 16 and repair or replace all defective work and equipment. Refer to the individual equipment sections for additional specific testing requirements.

B. Make adjustments to the systems and instruct the Owner's personnel in the proper operation of the systems.

C. In addition to the specific testing requirements listed in the individual Sections, the following minimum tests and settings shall be performed. Submit test reports upon completion of testing in accordance with Section 01300.

1. Mechanical inspection, testing and settings of circuit breakers, disconnect switches, motor starters, overload relays, control circuits and equipment for proper operation.

2. Check the full load current draw of each motor. Where power factor correction capacitors are provided the capacitor shall be in the circuit at the time of the measurement. Check ampere rating of thermal overloads for motors and submit a typed record to the Engineer of the same, including MCC cubicle location and driven load designation, motor service factor, horsepower, and Code letter. If incorrect thermal overloads are installed replace same with the correct size overload.

3. Check power and control power fuse ratings. Replace fuses if they are found to be of the incorrect size.

4. Check settings of the motor circuit protectors. Adjust settings to lowest setting that will allow the motor to be started when under load conditions.

5. Check motor nameplates for correct phase and voltage. Check bearings for proper lubrication.

6. Check rotation of motors prior to testing the driven load. Disconnect the driven equipment if damage could occur due to wrong rotation. If the rotation is incorrect for the driven equipment correct motor connections at the motor terminal box.

7. Check interlocking, control and instrument wiring for each system and/or part of a system to prove that the system will function properly as indicated by control schematic and wiring diagrams.

8. Inspect each piece of equipment in areas designated as HAZARDOUS to ensure that equipment of proper rating is installed.

9. Verify all terminations at transformers, equipment, panels and enclosures by producing a 1, 2, 3 rotation on a phase sequenced motor when connected to "A", "B" and "C" phases.

10. Check all wire and cable terminations. Verify to the Engineer connections meet the equipments torque requirements.

11. Field set all transformer taps as required to obtain the proper secondary voltage.

12. Infra-red hot spot inspection shall be made of all electrical equipment including but not limited to main circuit breakers, switchboards, motor control centers, transformers, switches, power and control panels, transfer switches, RVSS, VFD's etc. This shall be done under representative load conditions before the equipment is used by the Owner and again 3 months before expiration of the 1-year warranty period.

D. Testing shall be scheduled and coordinated in writing with the Engineer at least 2 weeks in advance. Provide qualified test personnel, instruments and test equipment. Provide certified calibration sheets including dates for all equipment to be used for testing with notice of scheduled testing. Calibration sheets shall also indicate that the units have been calibrated within six months of the testing date. The Contractor shall have qualified personnel present during the testing.

E. Test systems and equipment furnished under Division 16 and repair or replace all defective work and equipment. Refer to the individual equipment sections for additional specific testing requirements. Employ the services of an independent recognized power systems testing company, other than the Manufacturer of the switchgear or motor control centers, to perform the tests specified herein.

F. Field testing and commissioning shall be performed in accordance with the latest revisions of NETA Standard ATS "Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems" unless otherwise modified by these Sections.

G. A typed test report for each component tested shall be submitted to the Engineer for the project record files. The firm doing the testing shall include, in the report, their opinion whether or not the equipment being tested complies with the specification. Any discrepancies shall be noted in the concluding summary of the report. Test report forms shall be in compliance with NETA standards. A minimum of three complete copies shall be provided. Reports shall be signed by the person in responsible charge of the field testing, an officer of the firm performing the tests and an officer of the Electrical Contractor.

H. Make adjustments to the systems and instruct the Owner's personnel in the proper operation of the systems.

I. Make the following minimum tests and checks prior to energizing electrical equipment. Submit test reports upon completion in accordance with Section 01300.

1. Test and calibrate protective relays and circuit breakers.

2. Mechanical inspection of air interrupter switches and circuit breakers to assure proper operation.

1.10 PROTECTIVE DEVICES COORDINATION STUDY

A. General:

1. The major electrical equipment manufacturer (i.e. switchboards, motor control centers, panelboards, etc.) shall provide a computerized Power System Study for the electrical power distribution and motor control equipment. The study shall verify adequacy of all of the equipment installed at the Cabarrus County "Cabarrus County C&D Landfill".

2. The study shall also include the utility company's protective devices, the emergency generators, the main switchboards, all feeders from the main switchboards, all substations and distribution and all associated MCC's. Graphic indication of coordination shall be furnished in the form of a clearly labeled and identified composite drawing showing time-current curves of system protective devices. Time-current curves of each device shall also be furnished.

3. The Contractor/Manufacturer shall be responsible for obtaining and verifying with the Power Company in writing all information needed to conduct this study. Provide this correspondence and information including contacts and phone numbers with the study submittal.

4. The Contractor shall set all protective devices and relays based on this coordination study to provide coordinated, selective protection for all equipment supplied or affected by the installation under this Contract.

5. The Contractor/Manufacturer shall provide data necessary to perform the study. This includes feeder cable sizes, approximate feeder length, motor data, switchgear data, existing protective relay settings and any other information relevant to the study.

6. A summary of the short circuit analysis shall be provided to the Contractor at the time shop drawings for all of the new equipment is submitted for approval.

7. The Manufacturer shall be made aware that there is no available up-to-date single line diagram for the existing facilities. The Contractor/Manufacturer shall provide and/or update the existing single line diagram as required in order to perform the coordination and short-circuit study.

B. Scope:

1. The short circuit study shall be in accordance with ANSI Standard C37.010 and C37.13, shall be performed to check the adequacy, and to verify the correct application of circuit protective devices and other system components specified. The study shall address the

case when the system is being powered from the normal source as well as from the on-site generating facilities. Minimum as well as maximum possible fault conditions shall be adequately covered in the study.

2. Fault contribution of all motors shall be considered. The Contractor shall be responsible for obtaining all required data of equipment. All back-up calculations shall become part of the final report. The Calculations shall be in sufficient detail to allow easy review.

C. Contents:

1. The study shall include representation of the power company's systems, the base quantities selected, impedance source-data, calculation methods and tabulations, one-line and impedance diagrams, conclusions and recommendations. Short circuit momentary duties, shall be calculated on the basis of an assumed bolted three-phase short circuit at each medium voltage bus, low voltage switchboard bus, switchboards, motor control centers, distribution panelboards, pertinent branch circuit panelboards, and other significant locations through the systems. The short-circuit tabulations shall include significant X to R ratios, asymmetry factors, KVA, and symmetrical fault current.

2. A protective device time current coordination study shall be included with coordination plots of key and/or limiting devices, tabulated data, rating, and/or settings selected. The study shall present an engineering balance between the competing objectives of protection and continuity of service for the system specified, taking into account the basic factors of sensitivity, selectivity and speed.

3. Separate plots shall be provided for each mode of "normal" and "stand-by" operation. Maximum fault values shall be shown in each case. Both power sources shown in one plot will not be accepted.

4. Existing protective device settings shall be reviewed to ensure selectivity under the new conditions. Recommended changes shall be indicated in the report. The Contractor shall be made aware of required changes immediately.

5. Transformer damage curves in accordance with ANSI C57.109.

6. Feeder cable damage curves.

7. Required settings for breakers and relays shall be maximized to provide the most effective protection possible whether the system is fed from the normal or emergency source.

8. Tabulations indicating recommended set points for all protective devices shall be provided. This shall include the normal as well as the emergency source.

9. Generator short circuit decrement curves and thermal limit curves shall be included.

D. Motor Current-Time Characteristic Curves:

1. A complete independent set of current-time characteristic curves for all motor drives indicating coordination between the protective relays and the thermal characteristics of the motor shall be provided.

2. The Contractor shall obtain from the motor supplier, the necessary information to perform the study. Certified curves for "safe time versus current at 100 percent voltage" and

"accelerating time versus current at 100 percent voltage" shall become part of the final report.

E. Motor Starting Study:

1. A motor starting study for all large electric drives (100 horsepower and above) to determine voltage dip or power inrush limitations at selected locations due to starting of motors shall be provided. This applies to both the normal and the emergency mode.

F. General Information for Time-Current Curves Presentations:

1. The coordination plots shall include complete titles, representative one-line diagrams, legends, associated power company's relay or system characteristics, significant motor starting characteristics, complete parameters for power, and substation transformers, and complete operating bands for low-voltage circuit breaker trip devices.

2. The coordination plots shall define the types of protective devices selected, together with the proposed coil taps, time-dial settings and pick-up settings required.

3. The short-time region shall indicate the medium voltage relay instantaneous elements, the magnetizing in-rush, and ANSI withstand transformer parameters, the low-voltage circuit breaker instantaneous trip devices, fuse manufacturing to tolerance bands, and significant symmetrical and asymmetrical fault currents.

4. Each primary protective device required for a delta-to-wye connected transformer shall be selected so that the characteristic or operating band is within the transformer parameters; which, where feasible, shall include a parameter equivalent to 58 percent of the ANSI withstand point to afford protection for secondary line-to-ground faults.

5. Low-voltage power circuit breakers shall be separated from each other and the associated primary protective device, where feasible, by a 16 percent current margin for coordination and protection in the event of secondary line-to-line faults.

6. Protective relays shall be separated, where feasible, by a 0.3 second time margin when the maximum three-phase fault flows, to assure proper selectivity.

G. Generator(s) Protective Devices:

1. The study shall address all of the existing protective devices provided for generator protection.

2. Protective relays requiring settings shall include, but not necessarily limited to:

a. Differential

b. Overcurrent with voltage restraint

c. Ground

d. Undervoltage

e. Reverse power

f. Unbalanced loading and open phase

g. Loss of excitation

3. Contractor shall obtain all necessary new and existing generator information to perform this study.

H. The coordination study shall be bound in a standard 8-1/2" x 11" size report and submitted in accordance with Section 01300. The final selection of all protective devices shall be based on a preliminary draft of the coordination study which shall be submitted with the equipment shop drawings for review. The completed study shall be submitted to and approved by the Engineer before any of the equipment is shipped. All protective devices shall be adjusted, tested, and calibrated in the field, prior to energizing the equipment, per the settings listed in the study. This work shall be performed by the Manufacturer as described in this section and prior to final acceptance by the Owner.

I. All protective devices, existing and new shall be calibrated and tested as recommended by and under the supervision of the distribution gear manufacturer's representative as specified in this section.

J. The coordination study shall be stamped and signed by a professional engineer registered in the state in which the equipment is to be installed.

1.11 INTERPRETATION OF DRAWINGS

A. The Drawings are not intended to show exact locations of conduit runs. Coordinate the conduit installation with other trades and the actual supplied equipment.

B. Install each 3 phase circuit in a separate conduit unless otherwise shown on the Drawings.

C. Install circuits in individual conduits (i.e., no combining of circuits will be permitted unless otherwise shown) as shown on the drawings.

D. Unless otherwise approved by the Engineer, conduit shown exposed shall be installed exposed; conduit shown concealed shall be installed concealed.

E. Where circuits are shown as "home-runs" all necessary fittings and boxes shall be provided for a complete raceway installation.

F. Verify the exact locations and mounting heights of lighting fixtures, switches and receptacles prior to installation. Any adjustments required in the field shall be provided at no additional cost to the Owner and coordinated and approved by the Engineer.

G. Except where dimensions are shown, the locations of equipment, fixtures, outlets and similar devices shown on the Drawings are approximate only. Exact locations shall be determined by the Contractor and approved by the Engineer during construction. Obtain information relevant to the placing of electrical work and in case of any interference with other work, proceed as directed by the Engineer and furnish all labor and materials necessary to complete the work in an approved manner.

H. Circuit layouts are not intended to show the number of fittings, or other installation details. Furnish all labor and materials necessary to install and place in satisfactory operation all power, lighting and other electrical systems shown. Additional circuits shall be installed wherever

needed to conform to the specific requirements of the approved equipment at no additional cost to the Owner.

I. Redesign of electrical or mechanical work, which is required due to the Contractor's use of an alternate item, arrangement of equipment and/or layout other than specified herein, shall be done by the Contractor at his/her own expense. Redesign and detailed plans shall be submitted to the Engineer for approval. No additional compensation will be provided for changes in the work, either his/her own or others, caused by such redesign.

J. Surface mounted panel boxes, junction boxes, conduit, etc., shall be supported by 3/4- inch spacers to provide a clearance between wall and equipment.

K. All floor mounted electrical equipment shall be placed on 4-inch thick (3/4-inch, 45 degree chamfer at all exposed edges) concrete pads, provide reinforcement, anchors, etc.

L. The Contractor shall harmonize the work of the different trades so that interferences between conduits, piping, equipment, architectural and structural work will be avoided. All necessary offsets shall be furnished so as to take up a minimum space and all such offsets, fittings, etc, required to accomplish this shall be furnished and installed by the Contractor without additional expense to the Owner. In case interference develops, the Engineer is to decide which equipment, piping, etc., must be relocated, regardless of which was installed first.

M. Raceways and conductors for the fire alarm, security system and lightning protection system are not shown on the Drawings. Provide raceways and conductors as required by the system manufacturer for a complete and operating system. Raceways shall be installed concealed in all finished spaces and may be installed exposed or conducted in process spaces.

N. Raceways and conductors for miscellaneous low voltage power and signal systems as specified are not shown on the Drawings. Raceways and conductors shall be provided as required for a complete and operating system. Homeruns, as shown on the Drawings, are to assist the Contractor in identifying raceways to be run exposed and raceways to be run concealed. Raceways shall be installed concealed in all finished spaces. Raceways installed exposed shall be near the ceiling or along walls of the areas through which they pass and shall be routed to avoid conflicts with HVAC ducts, cranes hoists, monorails, equipment hatches, doors, windows, etc. Raceways installed concealed shall be run in the center of concrete floor slabs, above suspended ceilings, or in partitions as required.

1.12 PHASE BALANCING

A. The Drawings do not attempt to balance the electrical loads across the phases. Circuits on motor control centers and panelboards shall be field connected to result in evenly balanced loads across all phases.

B. Field balancing of circuits shall not alter the conductor color coding requirements as specified in Section 16120.

1.13 SIZE OF EQUIPMENT

A. Investigate each space in the structure through which equipment must pass to reach its final location. Coordinate shipping splits with the Manufacturer to permit safe handling and passage through restricted areas in the structure.

B. The equipment shall be kept upright at all times during storage and handling. When equipment must be tilted for passage through restricted areas, brace the equipment to ensure that the tilting does not impair the functional integrity of the equipment.

1.14 RECORD DRAWINGS

A. As the work progresses, legibly record all field changes on a set of Project Contract Drawings, hereinafter called the "Record Drawings".

B. Record Drawings shall accurately show the installed condition of the following items:

1. One-line Diagram(s).
2. Equipment elevations (front views).
3. Raceways and pullboxes.
4. Conductor sizes and conduit fills.
5. Panel Schedule(s).
6. Control Wiring Diagram(s).
7. Lighting Fixture Schedule(s).
8. Lighting fixture, receptacle and switch outlet locations.
9. Underground raceway and duct bank routing.
10. Plan view, sizes and locations of switchgear, distribution transformers, substations, motor control centers and panelboards.

C. Submit a schedule of control wiring raceways and wire numbers, including the following information:

1. Circuit origin, destination and wire numbers.
2. Field wiring terminal strip names and numbers.

D. In addition to the schedule, provide point-to-point connection diagrams showing the same information submitted in the schedule of control wiring raceways including all designations and wire numbers.

E. Submit the record drawings, schedule of control wiring raceways and wire numbers and the point-to-point connection diagrams to the Engineer. The schedule of control wiring raceways and wire numbers and the point-to-point connection diagrams shall be computer generated (i.e. no hand-written or drawn schedules, drawings, or diagrams will be accepted).

1.15 EQUIPMENT INTERCONNECTIONS

A. Review shop drawings of equipment furnished under other Divisions and prepare coordinated wiring interconnection diagrams or wiring tables. Submit copies of wiring diagrams or tables with the Record Drawings.

B. Furnish and install all equipment interconnections.

1.16 MATERIALS AND EQUIPMENT

A. Materials and equipment shall be new, except where specifically identified on the Drawings to be re-used.

B. Material and equipment of the same type shall be the product of one manufacturer and shall be UL listed.

C. Warrant all equipment furnished under Division 16 in accordance with Section 01740. Refer to individual equipment sections for additional warranty items.

1.17 EQUIPMENT IDENTIFICATION

A. Identify equipment (disconnect switches, separately mounted motor starters, control stations, etc) furnished under Division 16 with the name of the equipment it serves. Motor control centers, control panels, panelboards, switchboards, switchgear, junction or terminal boxes, transfer switches, etc, shall have nameplate designations as shown on the Drawings.

B. Nameplates shall be engraved, laminated plastic, not less than 1/16-in thick by 3/4-in by 2-1/2-in with 3/16-in high white letters on a black background.

C. Nameplates shall be screw mounted to NEMA 1 enclosures. Nameplates shall be bonded to all other enclosure types using an epoxy or similar permanent waterproof adhesive. Two sided foam adhesive tape is not acceptable. Where the equipment size does not have space for mounting a nameplate, the nameplate shall be permanently fastened to the adjacent mounting surface. Cemented nameplates shall not be drilled.

D. All voltages (e.g. 480 volts, 120 volts etc.) within pull boxes, junction boxes etc. shall be identified on the front exterior cover. Signs shall be red background with white engraved lettering, lettering shall be a minimum of 1" high.

E. All receptacles, wall switches, lighting fixtures, photo cells, emergency lights, exit lights, etc., shall be identified with the lighting circuit to which it is connected.

1.18 SAFETY REQUIREMENTS

A. The Contractor shall make every effort to keep all employees and/or subcontractors aware of the danger inherent in working in dangerous proximity to the existing power lines. The minimum recommended precautionary measures are as follows:

1. Make sure that all persons responsible for operating cranes, draglines and other mobile equipment have a copy of, and are familiar with the State Department of Commerce Regulations for Use of Cranes, Draglines and Similar Equipment Near Power Lines, as

well as the U.S. Department of Labor OSHA Regulations, before commencing operation of said equipment.

2. Make sure that all cranes, draglines and other mobile equipment have attached to them the black and yellow Department of Commerce warning signs required by the said Regulations of State Department of Commerce.

3. Warn all employees on the ground, new and old employees alike, of the danger of holding on to or touching a cable or other piece of equipment or machinery that is located or working close to any overhead power line.

4. If, during the course of construction, it becomes necessary for the contractor, or subcontractor, and their employees, to operate cranes, draglines, or their mobile equipment, in dangerous proximity of any overhead power lines, or in such a manner that such equipment might come close to any overhead power lines, the Contractor shall give the Power Company or overhead power line owner prior notice of such proposed operation.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 SLEEVES AND FORMS FOR OPENINGS

A. Provide and place all sleeves for conduits penetrating floors, walls, partitions, etc. Locate all necessary slots for electrical work and form before concrete is poured.

B. Exact locations are required for stubbing-up and terminating concealed conduit. Obtain shop drawings and templates from equipment vendors or other subcontractors and locate the concealed conduit before the floor slab is poured.

C. Where setting drawings are not available in time to avoid delay in scheduled floor slab pours, the Engineer may allow the installations of such conduit to be exposed. Requests for this deviation must be submitted in writing. No additional compensation for such change will be allowed.

D. Seal all openings, sleeves, penetration and slots as specified in Section 16110.

3.02 CUTTING AND PATCHING

A. Cutting and patching shall be done in a thoroughly workmanlike manner and be in compliance with modifications and repair to concrete as specified in Section 03740. Sawcut concrete and masonry prior to breaking out sections.

B. Core drill holes in existing concrete floors and walls as required.

C. Install work at such time as to require the minimum amount of cutting and patching.

D. Do not cut joists, beams, girders, columns or any other structural members.

E. Cut opening only large enough to allow easy installation of the conduit.

F. Patching to be of the same kind and quality of material as was removed.

G. The completed patching work shall restore the surface to its original appearance or better.

H. Patching of waterproofed surfaces shall render the area of the patching completely waterproofed.

I. Remove rubble and excess patching materials from the premises.

J. When existing conduits are cut at the floor line or wall line, they shall be filled with grout of suitable patching material.

3.03 INSTALLATION

A. Any work not installed according to the Drawings and this Division or without approval by the Engineer shall be subject to change as directed by the Engineer. No extra compensation will be allowed for making these changes.

B. Electrical equipment shall at all times during construction be adequately protected against mechanical injury or damage by water. Electrical equipment shall not be stored out-of-doors. Electrical equipment shall be stored in dry permanent shelters. If an apparatus has been damaged, such damage shall be repaired at no additional cost. If any apparatus has been subject to possible injury by water, it shall be replaced at no additional cost to the Owner, the damaged unit(s) or systems shall remain on site and returned to the Manufacturer after the replacement unit(s) or systems have been delivered to the site. Under no circumstances will electrical equipment damaged by water be rehabilitated or repaired, new equipment shall be supplied and all cost associated with replacement shall be borne by the Contractor.

C. Equipment that has been damaged shall be replaced or repaired by the equipment manufacturer, at the Engineer's discretion.

D. Repaint any damage to factory applied paint finish using touch-up paint furnished by the equipment manufacturer. The entire damaged panel or section shall be repainted per the field painting requirements Section 09902, at no additional cost to the Owner.

3.04 MANUFACTURERS SERVICE

A. Provide Manufacturer's services for testing and start-up of the following equipment:

1. 480 Volt Switchgear (2 day 2 trips minimum)

2. Reduced Voltage Auto Transformer (1 day 1 trips minimum)

B. Testing and startup shall not be combined with training. Testing and start-up time shall not be used for Manufacturers warranty repairs.

C. The Manufacturers of the above listed equipment shall provide experienced Field Service Engineer to accomplish the following tasks:

1. The equipment shall be visually inspected upon completion of installation and prior to energization to assure that wiring is correct, interconnection complete and the installation is in compliance with the Manufacturer's criteria. Documentation shall be reviewed to assure that all Drawings, operation and maintenance manuals, parts list and other data required to check out and sustain equipment operation is available on-site. Documentation

shall be red-lined to reflect any changes or modifications made during the installation so that the "as-built" equipment configuration will be correctly defined. Spare parts shall be inventoried to assure correct type and quantity.

2. The Field Service Engineers shall provide engineering support during the energization and check-out of each major equipment assembly. They shall perform any calibration or adjustment required for the equipment to meet the Manufacturer's performance specifications.

3. Upon satisfactory completion of equipment test, they shall provide engineering support of system tests to be performed in accordance with Manufacturer's test specifications.

4. A final report shall be written and submitted to the Contractor within fourteen days from completion of final system testing. The report shall document the inspection and test activity, define any open problems and recommend remedial action. The reports after review by the Contractor shall be submitted to the Engineer.

3.05 TRAINING

A. Provide Manufacturer's services for training of plant personnel in operation and maintenance of the equipment specified under Division 16 and Section 01664.

1. 480 Volt Switchgear (2 day 2 trips minimum)

2. Reduced Voltage Auto Transformer (1 day 1 trips minimum)

B. The cost of training programs to be conducted with Owner's personnel shall be included in the Contract Price. The training and instruction, insofar as practicable, shall be directly related to the system being supplied.

C. Provide detailed O&M manuals to supplement the training courses. The manuals shall include specific details of equipment supplied and operations specific to the project.

D. The training program shall represent a comprehensive program covering all aspects of the operation and maintenance including trouble-shooting of each system.

E. All training schedules shall be coordinated with and at the convenience of the Owner. Shift training may be required to correspond to the Owner's working schedule. The training shall be conducted with record "as-built" drawings sufficient for a class of eight personnel.

F. Within 120 days of contract award to the Contractor, submit an overview of the proposed training plan. This overview shall include, for each course proposed:

1. An overview of the training plan.

2. Course title and objectives.

3. Prerequisite training and experience of attendees.

4. Recommended types of attendees.

5. Course Content - A topical outline.

6. Course Duration.

7. Course Location - Training center or jobsite.

8. Course Format - Lecture, laboratory demonstration, etc.

9. Schedule of training courses including dates, duration and locations of each class.

10. Resumes of the instructors who will actually implement the plan.

G. The Engineer will review the training plan submittal with the Owner.

3.06 POWER SYSTEM STUDY

A. Provide a complete system short circuit and selective coordination study as specified herein.

END OF SECTION

SECTION 16110

RACEWAYS, BOXES, FITTINGS AND SUPPORTS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install complete raceway systems as shown on the Drawings and as specified herein.

1.02 RELATED REQUIREMENTS

A. Refer to Section 16600 for additional requirements.

1.03 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01300 for approval by the Owner, the Manufacturers' names and product designation or catalog numbers with cut-sheets of all materials specified. Indicate in the submittal, the areas where specific materials are used.

PART 2 PRODUCTS

2.01 MATERIALS

A. Rigid Aluminum Conduit

1. Rigid aluminum conduit shall be 6063 alloy and shall be as manufactured by New Jersey Aluminum Corp.; Reynolds Aluminum International Services Inc.; Alumax Extrusions, Inc; VAW of America, Inc. or equal.

2. Rigid aluminum conduit shall be for use under the provisions of NEC Article 346.

B. Rigid Steel Conduit PVC Coated

1. Rigid steel conduit interior and exterior shall be hot-dipped galvanized and be as manufactured by the Allied Tube and Conduit Corp., Wheatland Tube Co. or equal.

2. Rigid steel conduit shall be galvanized after threading.

3. Rigid steel conduit shall be for use under the provisions of NEC Article 344.

C. Electrical Metallic Tubing

1. Electrical metallic tubing shall be hot-dipped galvanized steel as manufactured by the Allied Tube and Conduit Corp.; Triangle PWC Inc.; Wheatland Tube Co.; Bridgeport or equal.

2. Electrical metallic tubing shall be for use under the provisions of NEC Article 358.

D. Rigid Nonmetallic Conduit

1. PVC conduit shall be rigid polyvinyl chloride schedule 80 as manufactured by Carlon; An Indian Head Co.; Cantex; Queen City Plastics or equal.

2. PVC conduit used in underground concrete encased duct banks shall be rigid polyvinyl chloride Type DB as manufactured by Carlon; An Indian Head Co.; Cantex; Queen City Plastics or equal.

3. PVC conduit shall be for use under the provisions of NEC Article 352.

E. Liquidtight Flexible Metal Conduit, Couplings and Fittings

1. Liquidtight flexible metal conduit shall be Sealtite, Type UA, manufactured by the Anaconda Metal Hose Div.; Anaconda American Brass Co.; American Flexible Conduit Co., Inc.; Universal Metal Hose Co. or equal.

2. Fittings used with liquidtight flexible metal conduit shall be of the 3-piece screw-in type malleable iron as manufactured by the O.Z. Gedney Co. or equal.

3. Liquidtight flexible metal conduit shall be for use under the provisions of NEC Article 350.

F. Flexible Metallic Tubing

1. Flexible metallic tubing shall be for use under the provisions of NEC Article 349.

2. Flexible metallic tubing shall be hot-dipped galvanized steel strips shaped into interlocking convolutions firmly joined to one another assuring a complete lock similar to Tristeel as manufactured by Triangle - PWC, Inc. or equal.

3. Flexible metallic tubing shall be used only indoors for connection to lighting fixtures in NEMA 1 administration and office areas.

4. Furnish and install insulated bushings at terminations for conductor protection.

G. Flexible Couplings

1. Flexible couplings shall be type ECGJH as manufactured by the Crouse-Hinds Co.; Appleton Electric Co.; Killark Electric Manufacturing Co. or equal.

H. Boxes and Fittings

1. Pressed steel switch and outlet boxes shall be hot-dipped galvanized with hot-dipped galvanized tile rings as manufactured by the Raco Manufacturing Co.; Adalet Co.; O.Z. Manufacturing Co. or equal.

2. NEMA 1 and NEMA 12, junction boxes, pull boxes etc., shall be sheet steel unless otherwise shown on the Drawings. Boxes shall be galvanized and have continuously welded seams. Welds shall be ground smooth and galvanized. Box bodies shall be flanged and shall not have holes or knockouts. Box bodies shall not be less than 14 gauge metal and covers shall not be less than 12 gauge metal. Covers shall be gasketed and fastened with stainless steel screws. Terminal boxes shall be furnished with hinged doors, terminal

mounting straps and brackets (refer to Section 16191 for additional requirements). Boxes shall be as manufactured by Hoffman Engineering Co.; Lee Products Co.; ASCO Electrical Products Co., Inc., or equal. All boxes shall be shop primed and painted by the box manufacturer.

3. NEMA 4X stainless steel, junction boxes and pull boxes shall be Electropolish 316stainless steel with Electropolish 316stainless steel hardware and gasketed covers. Boxes shall have continuously welded seams and welds shall be ground smooth. Box bodies shall be flanged and shall not have holes or knockouts. Box bodies shall not be less than 14 gauge metal and covers shall not be less than 12 gauge metal. Covers shall be gasketed and fastened with stainless steel screws. Terminal boxes shall be furnished with hinged doors, terminal mounting straps and brackets (refer to Section 16191 for additional requirements.) Boxes shall be as manufactured by Hoffman Engineering Co.; Lee Products Co.; ASCO Electrical Products Co., Inc., or equal.

4. Explosion-proof boxes shall be designed for Class 1, Group D, Division 1 hazardous locations. They shall be cast aluminum, with stainless steel hinged covers and stainless steel hardware and bolts; Type EJB-N4 as manufactured by the Crouse-Hinds Co.; Appleton Electric Co.; Adalet-PLM or equal.

5. Cast malleable iron device boxes shall be Type FD. All cast malleable iron boxes and fittings shall have cadmium-zinc finish with cast covers and stainless steel screws as manufactured by the Crouse-Hinds Co. or equal.

6. Cast malleable iron fittings (C's, T's, LB's, etc.) shall be of the mogul design (with rollers) as manufactured by Appleton Electric Co or equal.

7. Multi-Outlet Assembly

   a. Multi-Outlet Assembly shall only be used where specifically indicated on the drawings. The assembly enclosures shall consist of two piece, all steel or anodized aluminum raceways which shall allow for field installation of wiring and standard receptacles.

   b. Multi outlet assemblies shall be UL Listed as a Multi-outlet assembly.

   c. Raceway bases and removable covers shall be .040-in steel, minimum of 2-1/8-in high by 1-5/8-in deep. Entrance fittings shall be sized for 3/4-in conduit.

   d. Raceways shall include all fittings, couplings, etc, for the complete installation of a finished system.

   e. Device covers shall be the 1702 Series by Walker, similar by Isoduct; Wiremold or equal.

   f. The multi-outlet assembly shall be the 1700 Series by Walker, similar by Isoduct; Wiremold or equal.

8. Pedestal boxes for laboratory bench receptacles shall be cast aluminum, polished finish, single face with 1/2-in NPT tapped inlet, single gang: J.A. Pink Catalog No. 800-A; double gang: J.A. Pink Catalog No. 801-A, similar by Hubbell or equal.

9. Floor boxes shall be of the adjustable single gang, concrete tight type for installation in concrete fill, Walker 800 Series, similar by Hubbell; Thomas & Betts Co. or equal.

10. Conduit hubs shall be of the grounding type as manufactured by Myers Electric Products, Inc. or equal.

11. Conduit wall seals for new concrete walls below grade shall be O.Z./Gedney Co., Type WSK; Spring City Electrical Manufacturing Co., Type WDP or equal.

12. Conduit wall seals for cored holes shall be Type CSML as manufactured by the O.Z./Gedney Co. or equal.

13. Conduit wall and floor seals for sleeved openings shall be Type CSMI as manufactured by the O.Z./Gedney Co. or equal.

14. Combination expansion-deflection fittings embedded in concrete shall be Type XD as manufactured by the Crouse-Hinds Co.; O.Z./Gedney Co.; Spring City Electrical Mfg. Co. or equal.

15. Combination expansion-deflection fittings installed exposed shall be Type XJ as manufactured by Crouse-Hinds Co.; O.Z. Gedney Co.; Spring City Electrical Mfg. Co. or equal.

16. Explosion proof fittings shall be as manufactured by the Crouse-Hinds Co.; Appleton Electric Co.; O.Z./Gedney Co. or equal.

17. Conduit sealing bushings shall be O.Z./Gedney, Type CSB or equal.

18. Steel elbows and couplings shall be hot-dipped galvanized.

19. Electrical metallic tubing fittings shall be of the steel, raintight, concrete-tight, insulated throat (connectors), compression type as manufactured by the Appleton Electric Co.; Crouse-Hinds Co. or equal.

I. Conduit Mounting Equipment

1. In dry indoor non-process areas, hangers, rods, backplates, beam clamps, channel, fasteners, anchors, nuts, washers, etc., shall be hot-dipped galvanized steel.

2. Electropolish 316Stainless steel channel with Electropolish 316stainless steel hardware (hangers, rods, backplates, beam clamps, fasteners, anchors, nuts, washers, etc.) shall be used in process areas, as shown on the drawings, in areas designated "WET", "DAMP" and "CORROSIVE" on the Drawings and in outdoor locations. All channel and hardware shall be resistant to the chemicals present in the area in which it is used.

3. Expansion anchors (minimum 3/8" diameter) shall be equal to Kwik-Bolt as manufactured by the McCullock Industries, Minneapolis, MI; Wej-it by Wej-it Expansion Products, Inc., Bloomfield, CO; or Kwik-Bolt II as manufactured by the Hilti Fastening Systems, Inc, Tulsa, OK. The length of expansion bolts shall be sufficient to place the wedge portion of the bolt a minimum of 1-in behind the steel reinforcement. Apply anti-seize compound to all nuts and bolts. Supports installed without the approved compound shall be dismantled and correctly installed, at no cost to the Owner.

J. Wall and Floor Slab Opening Seals

1. Wall and floor slab openings shall be sealed with "FLAME-SAFE" as manufactured by the Thomas & Betts Corp.; Pro Set Systems; Neer Mfg. Co.; Specified Technologies, Inc. or equal.

K. Cold Galvanizing Compound

1. Cold galvanizing compound shall be 95% zinc rich paint as manufactured by ZRC Products Company, a Division of Norfolk Corp. or equal.

PART 3 EXECUTION

3.01 RACEWAY APPLICATIONS

A. Except where otherwise shown on the Drawings, or specified, all wiring shall be in rigid aluminum conduit.

B. Rigid aluminum conduit shall be used at all locations (underground and within structures) as raceways for shielded process instrumentation wiring, shielded control wiring, data highway wiring and I/O wiring.

C. Schedule 80 PVC conduit shall be used where shown on the Drawings and in chemical rooms, chlorinator rooms and chlorine storage areas or areas designated "CORROSIVE" on the Drawings.

D. Rigid aluminum conduit or Schedule 80 PVC shall be used underground where concrete encasement is not called for or as specified in Paragraph 3.01B above. Where schedule 80 PVC is used all elbows shall be rigid aluminum.

E. PVC conduit shall be used for concrete encased underground duct banks except as specified in Paragraph 3.01B above and except as specified in Section 16600.

F. Electrical metallic tubing and fittings may be used only in NEMA 1 administration and office areas. Electrical metallic tubing and fittings shall not be embedded in concrete, installed outdoors, in process areas, shops, maintenance areas, electrical rooms, etc.

G. All conduit of a given type shall be the product of one manufacturer.

3.02 BOX APPLICATIONS

A. Unless otherwise specified herein or shown on the Drawings, all boxes shall be metal.

B. Exposed switch, receptacle and lighting outlet boxes and condulet fittings shall be cast malleable iron.

C. Concealed switch, receptacle and lighting outlet boxes shall be pressed steel. Welded seamed boxes will not be permitted.

D. Terminal boxes, junction boxes and pull boxes shall have NEMA ratings suitable for the location in which they are installed, as specified in Section 16000.

3.03 FITTINGS APPLICATIONS

A. Combination expansion-deflection fittings shall be used where conduits cross structure expansion joints. Refer to Structural Drawings for expansion joint locations. Provide bonding jumpers around fittings.

B. Conduit wall seals shall be used where underground conduits penetrate walls or at other locations shown on the Drawings.

C. Conduit sealing bushings shall be used to seal conduit ends exposed to the weather and at other locations shown on the Drawings.

3.04 INSTALLATION

A. No conduit smaller than 3/4 inch electrical trade size shall be used, nor shall any have more than the equivalent of three 90 degree bends in any one run. Pull boxes shall be provided as required or directed.

B. No wire shall be pulled until the conduit system is complete in all details; in the case of concealed work, until all rough plastering or masonry has been completed; in the case of exposed work, until the conduit system has been completed in every detail.

C. The ends of all conduits shall be tightly plugged to exclude dust and moisture during construction.

D. Conduit supports, other than for underground raceways, shall be spaced at intervals of 8-ft or less, as required to obtain rigid construction.

E. Single conduits shall be supported by means of malleable iron one-hole pipe clamps in combination with malleable iron one-screw back plates, to raise conduits from the surface. Multiple runs of conduits shall be supported on trapeze type hangers with steel horizontal members and threaded hanger rods. The rods shall be not less than 3/8-in diameter. Surface mounted panel boxes, junction boxes, conduit, etc, shall be supported by spacers to provide a minimum of 1/2"-in clearance between wall and equipment.

F. Conduit hangers shall be attached to structural steel by means of beam or channel clamps. Where attached to concrete surfaces, concrete expansion anchors shall be provided.

G. All conduits on exposed work, within partitions and above suspended ceilings, shall be run at right angles to and parallel with the surrounding wall and shall conform to the form of the ceiling. No diagonal runs will be allowed. Bends in parallel conduit runs shall be concentric. All conduit shall be run perfectly straight and true.

H. Conduit terminating in pressed steel boxes shall have double locknuts (malleable iron) and insulated grounding bushings.

I. Conduit terminating in gasketed enclosures shall be terminated with grounding type conduit hubs.

J. Conduits containing equipment grounding conductors and terminating in sheet steel boxes shall have insulated throat grounding bushings with lay-in type lugs.

K. Conduits shall be installed using threaded fittings unless otherwise specified herein.

L. Liquidtight flexible metal conduit shall be used for all motor terminations, the primary and secondary of transformers, generator terminations and other equipment where vibration is present.

M. Flexible couplings shall be used in hazardous locations for all motor terminations and other equipment where vibration is present.

N. Where conduits pass through openings in walls or floor slabs, the remaining openings shall be sealed against the passage of flame and smoke.

O. PVC conduit to non-metallic and metallic box connections shall be made with sealing rings, with a stainless steel retainer as manufactured by Thomas & Betts Co or equal.

P. Conduit ends exposed to the weather shall be sealed with conduit sealing bushings.

Q. Expansion fittings shall be used on exposed runs of PVC conduit where required for thermal expansion. Installation and number of fittings shall be as provided per the NEC and approved by the PVC conduit manufacturer.

R. All conduit entering or leaving a motor control center, switchboard or other multiple compartment enclosure shall be stubbed up into the bottom horizontal wireway or other manufacturer designated area, directly below the vertical section in which the conductors are to be terminated.

S. Conduit sealing and drain fittings shall be installed in areas designated as NEMA 7.

T. Spare conduits and conduit stubouts for future construction shall be provided with threaded PVC end caps at each end.

U. No unbroken run shall exceed 300 feet in length. This length shall be reduced by 75 feet for each 90 degree elbow.

V. Galvanized steel conduit entering manholes and below grade pull boxes shall be terminated with grounding type bushings and connected to a 5/8" x 10' rod with a #6 bare copper wire.

W. Underground circuits shall be installed directly to the respective motor control centers, lighting panels, etc., except stainless steel pull boxes shall be wall mounted on structures to eliminate excessive bends. With prior written approval, below grade pull boxes may be used. Splices shall not be made in above or below grade pull boxes unless otherwise indicated on the plans and approved in writing by the Engineer.

X. All conduits shall have a 4-inch concrete housekeeping pad at all slab and grade penetrations. The housekeeping pad shall have 45 degree, 3/4-inch chamfer at all exposed edges.

Y. All field cut threads on galvanized steel conduit shall be cleaned and painted with cold galvanizing compound before installation.

Z. All risers from underground, concrete pads, floors, etc. shall be provided with heat shrink tubing (Raychem Co. or equal) from a point 1 foot-0-inch below bottom of slab or grade to a point not less than 6 inches above grade or surface of slab.

AA. Existing conduits are to be reused only where specifically noted on the drawings. Mandrels shall be pulled through all existing conduits which will be reused and through all new conduits 2-in in diameter and larger prior to installing conductors.

BB. 3/16-in polypropylene pull lines shall be installed in all new conduits noted as spares or designated for future equipment.

CC. Where no size is indicated for junction boxes, pull boxes or terminal cabinets, they shall be sized in accordance with the requirements of NEC Article 370.

DD. Conduits shall not cross pipe shafts, access hatches or vent duct openings. They shall be routed to avoid such present or future openings in floor or ceiling construction.

EE. The use of running threads is prohibited. Where such threads are necessary, a 3-piece malleable iron union shall be used.

FF. Conduits passing from heated to unheated spaces, exterior spaces, refrigerated spaces, cold air plenums, etc, shall be sealed with "Duxseal" as manufactured by Manville or seal fitting to prevent the accumulation of condensation.

GG. All field cut ends of hot dipped galvanized mounting channel shall be cleaned and painted with **95% zinc rich** cold galvanizing compound before installation.

HH. All underground control and instrumentation conduits shall be separated from power conduits by a minimum of 12 inches unless specifically noted otherwise. Crossing of control and instrumentation conduits with power conduits shall be kept to a minimum and where they must cross they shall cross at 90 degree angles.

END OF SECTION

SECTION 16120

WIRES AND CABLES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish, install and test all wire, cable and appurtenances as shown on the Drawings and as specified herein.

B. Install data highway, fiber optic, coaxial and I/O cables furnished under Division 13.

1.02 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01300 for approval by the Owner, samples of proposed wire. Each sample shall have the size, type of insulation and voltage stenciled on the jacket.

B. Approved samples will be sent to the project location for comparison by the "Owner" with the wire actually installed.

C. Installed unapproved wire shall be removed and replaced at no additional cost to the Owner.

1.03 DELIVERY, STORAGE AND HANDLING

A. Carefully handle all conductors to avoid kinks and damage to insulation.

PART 2 PRODUCTS

2.01 GENERAL

A. Wires and cables shall be of annealed, 98 percent conductivity, soft drawn copper.

B. All conductors shall be stranded, except that lighting and receptacle wiring may be solid.

C. Except for control, signal and instrumentation circuits, wire smaller than No. 12 AWG shall not be used.

D. All wire of a given type shall be the product of a single manufacturer.

2.02 MATERIALS

A. 600 Volt or Less Wire and Cable

1. Wire for lighting, receptacles, and other circuits not exceeding 150 volts to ground shall be NEC type XHHW. Below grade and underground the wire shall be type XHHW.

2. Wire for circuits over 150 volts to ground shall be NEC type XHHW up to 4/0 and shall be RHW for wire 250 MCM and larger.

3. Wire for control circuits shall be #14 AWG minimum NEC type XHHW stranded.

4. Equipment grounding conductors shall be installed in all raceways. Conductors shall be NEC type THW or XHHW, green and sized per NEC Table 250.122. Ground grid conductors shall be uninsulated unless shown otherwise on the Drawings.

5. Types XHHW and THW wire shall be as manufactured by the Southwire Co., Cablec Corp., Okonite Corp., or equal.

6. Multi-conductor control cable shall be stranded, #14 AWG, 600 V, cross-linked polyethylene insulated w/PVC jacket. Type "XLP" as manufactured by the Southwire Co., American Insulated Wire Corp., or equal.

7. Telephone cable shall be #22 AWG, 4-pairs, solid copper PVC insulation and PVC jacket. UL rated Type CMR as manufactured by American Insulated Wire Corp., or equal.

8. Multi-conductor power cable shall be stranded, 600V, cross-linked polyethylene insulated with PVC jacket, Type "TC" (XLP) with ground as manufactured by Southwire Co., Rockbestos Co., American Insulated Wire Corp., or equal.

2.03 INSTRUMENTATION WIRE

A. Process instrumentation wire shall be twisted pair, 600 V, cross linked polyethylene insulated, aluminum tape shielded, polyvinyl chloride jacketed type "XLP" as manufactured by the Rockbestos Co., or equal.

B. Cable for 4-20 mA instrumentation, potentiometer, RTD and similar analog circuits shall be multi-conductor twisted and shielded.

1. Single pair cable:

   a. Conductors: 2 No. 16 AWG stranded and twisted

   b. Insulation: XLP

   c. Shield: 100 percent tape with drain wire

   d. Jacket: PVC with UL and manufacturers identification

2. Three conductor (triad) cable:

   a. Conductors: 3 No. 16 AWG stranded and twisted

   b. Insulation: XLP

   c. Shield: 100 percent tape with drain wire

   d. Jacket: PVC with UL and manufacturers identification

3. Multiple pair cables (where shown on the Drawings):

   a. Conductor: Multiple 2 No. 16 AWG stranded and twisted

b. Insulation: XLP

c. Shield: Individual pairs and overall shielded with 100 percent tape and drain wire

d. Jacket: PVC with UL manufacturers identification

2.04 TERMINATIONS AND SPLICES (POWER CONDUCTORS)

A. Unless otherwise indicated on the plans, no splices may be made in the cables without prior written approval of the Engineer. Where splicing is approved, then splicing material shall be approved by the Engineer and cable manufacturer. Splicing materials for all 600 volt splices shall be made with long barrel tin plated copper compression (hydraulically pressed) connectors and insulated with heavy wall heat shrinkable tubing. The conductivity of all completed connections shall be not less than that of the uncut conductor. The insulation resistance of all completed connections of insulated conductors shall be not less than that of the uncut conductor.

B. 600 volt wire lugs shall be tin plated copper, long barrel compression type (hydraulically pressed) for wire sizes No. 8 AWG and larger. Lugs for No. 10 AWG and smaller wire shall be locking spade type with insulated sleeve. Lugs shall be as manufactured by the Thomas and Betts Co., or equal.

2.05 TERMINATION AND SPLICES (CONTROL CONDUCTORS)

A. A. Unless otherwise indicated on the plans, no splices may be made in the cables without prior written approval of the Engineer. Where splicing is approved, then splicing material shall be approved by the Engineer and cable manufacturer. Splicing materials and installation shall be as required by the Engineer. The conductivity of all completed connections shall be not less than that of the uncut conductor. The insulation resistance of all completed connections of insulated conductors shall be not less than that of the uncut conductor.

B. Termination connectors shall be of the expanded vinyl insulated locking fork-end (upturned leg ends) type as manufactured by Ideal Industries; 3M Co.; Panduit Corp. or equal.

2.06 TERMINATIONS (INSTRUMENTATION CABLES)

A. Termination connectors shall be of the expanded vinyl insulated locking fork-end (upturned leg ends) type as manufactured by Ideal Industries; 3M Co.; Panduit Corp. or equal.

2.07 MOTOR CONNECTIONS

A. For wire sizes #8 AWG and larger, long barrel tin plated copper compression (hydraulically pressed) type connections (Bundy Co., or equal) shall be installed on the branch circuit wires and the motor leads. Bolted connections shall utilize products which are rated for vibration applications (bolt, nut and spring washer). All connections shall be insulated with heavy duty heat shrinkable material (Raychem Corp. or equal).

2.08 WIRE AND CABLE MARKERS

A. Wire and cable markers shall be type written, heat shrinkable type as manufactured by the W.H. Brady Co., Thomas & Betts Co., 3M Co., or equal.

B. Wire and cables with diameters exceeding the capacity of the heat shrinkable markers shall be marked with pre-printed, self-adhesive vinyl tapes as manufactured by the W.H. Brady Co., Panduit Corp., or equal.

C. Wire and cable markers shall use loop numbers to identify electrical designations (i.e. 0100-1, etc.).

2.09 WALL AND FLOOR SLAB OPENING SEALS

A. Wall and floor slab openings shall be sealed with "FLAME-SAFE" as manufactured by the Thomas & Betts Corp. or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Uniquely identify all wires, cables and each conductor of multi-conductor cables (except lighting and receptacle wiring) at each end with wire and cable markers.

B. Use lubrications to facilitate wire pulling. Pulling compound shall be nontoxic, nonflammable, noncombustible and noncorrosive. The material shall be UL listed and compatible with the cable insulation and jacket.

C. All wire and cable shall be continuous and without splices between points of connection to equipment terminals, except a splice will be permitted by the Engineer if the length required between the points of connection exceeds the greatest standard shipping length available from the Manufacturer specified or approved by the Engineer as the Manufacturer of the particular item or wire and cable.

D. Seal openings in slabs and walls through which wires and cables pass.

E. Steel fish tapes and/or steel pulling cables shall not be used in PVC conduit runs.

F. Pull cable from direction that requires the least tension.

G. Feed cable into raceway with zero tension and without cable crossover at raceway entrance.

H. Use a feed-in tube and sheave designed for cable installation. Use sheaves with radii that exceed the cable manufacturer's recommended minimum bending radius.

I. Use a dynamometer and constant velocity power pulling. Velocity should not be less than 15-ft./min or more than 50-ft/min. Do not exceed the cable manufacturer's maximum recommended tension.

J. If cable cannot be terminated immediately after installation install heat shrinkable end caps.

K. Uniquely identify all cable at supply and receiving ends and in all manholes, handholes or pullboxes. Use embossed brass tags and tywrap fasteners.

L. Hydraulically or manually operated cable benders shall not be used unless approved in writing by the Engineer.

M. Instrumentation cables shall be installed in rigid steel conduits as specified. All circuits shall be installed as twisted pairs or triads. In no case shall a circuit be made up using conductors from different pairs or triads. Triads shall be used wherever three wire circuits are required.

N. Install shielded instrumentation wire from terminal to terminal with no splicing at any intermediate point. Shielded instrumentation wire, coaxial, data highway, I/O and fiberoptic cables shall be run without splices between instruments, terminal boxes, or panels.

O. Terminal blocks shall be provided at all instrument cable junctions, and all circuits shall be identified at such junctions.

P. Ground shielding on instrumentation wire at one end only as recommended by the instrument manufacturer and isolated at all other locations. Terminal blocks shall be provided for inter-connecting shield drain wires at all junction boxes. Where individual circuit shielding is required, each shield circuit shall be provided with its own terminal block.

Q. Install shielded instrumentation wire in conduit and pull boxes that contain only shielded instrumentation wire. Instrumentation cables shall be separated from all other (i.e. power, control, etc.) cables in manholes.

R. All shielded cable terminations at each end shall be provided with heat shrinkable tubing placed over the exposed shield and conductors. The tubing shall extend 1" minimum over the jacket end and extend 1/2" minimum from the jacket end over the exposed conductors.

3.02 WIRE COLOR CODE

A. All wire shall be color coded or coded using electrical tape in sizes where colored insulation is not available. Where tape is used as the identification system, it shall be applied in all junction boxes, manholes and other accessible intermediate locations as well as at each termination.

B. The following coding shall be used:

System	Wire	Color
240/120 Volts Single-Phase, 3 Wire	Neutral	White
	Line 1	Black
	Line 2	Red
208Y/120, Volts 3 Phase, 4 Wire	Neutral	White
	Phase A	Black
	Phase B	Red
	Phase C	Blue
240/120 Volts 3 Phase, 4 Wire delta, center tap ground on phase coil A-C	Neutral	White
	Phase A	Black
	Phase B (High)	Orange
	Phase C	Blue
480Y/277 Volts 3 Phase, 4 Wire	Neutral	White
	Phase A	Brown
	Phase B	Orange

	Phase C	Yellow
Control (Individual Conductors)	AC	Red
	DC	Blue

3.03 FIELD TESTING

A. Test all 600 volt wire insulation with a megohm meter after installation and prior to termination. Make tests at not less than 1000 volts DC. Submit a written test report of the results to the Engineer. Notify Engineer in writing 48 hours prior to testing.

B. Field testing and commissioning shall be done in accordance with the latest revision of the "Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems" published by the InterNational Electrical Testing Association (NETA Standard ATS-2003) unless otherwise modified by this Section. Minimum wire insulation resistance shall not be less than 250 Megohms.

C. All service conductors shall be tested as in paragraph A above with the Engineer present.

END OF SECTION

SECTION 16150

MOTORS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. All motors shall be furnished as called for in other Sections of these Specifications and on the electrical drawings and shall be in conformance with the requirements of this section.

1.02 QUALIFICATIONS

A. Routine tests shall be performed on representative motors, and shall include the information described on NEMA MG1-12.54 "Report of Test Form for Routine Tests on Induction Motors". Efficiency shall be determined in accordance with IEEE Publication No. 112, Method B. Power factor shall be measured on representative motors.

1.03 SUBMITTALS

A. Submittal of motor data for acceptance shall include complete nameplate data and test characteristics in accordance with NEMA Standard MG1-12.54 "Report of Test Form for Routine Tests on Induction Motors" and, in addition, the following for motors typical of the units furnished:

1. Efficiency at 1/2, 3/4 and full load
2. Power factor at 1/2, 3/4 and full load
3. Motor outline, dimensions and weight
4. Descriptive bulletins, including full description of insulation system
5. Bearing design data
6. Special features (i.e., space heaters, temperature detectors, etc.)
7. Power factor correction capacitor rating and type.

B. The motor manufacturer shall submit to the Engineer as provided in Section 01300 for approval by the Owner, certified dimension prints showing nameplate data and outline dimensions within three weeks of the date they receive the order.

C. Guarantee: All equipment furnished and installed under this Section shall be guaranteed against defects of workmanship, materials and proper installation for a period of one (1) year from date of acceptance. All such equipment or parts proven defective, due to the above noted causes, shall be replaced in the machines by the Contractor at no expense to the Owner.

D. Provide equipment warranty in accordance with Section 01740.

1.04 REFERENCE STANDARDS

A. Institute of Electrical and Electronics Engineers (IEEE)

B. National Electrical Manufacturers Association (NEMA)

C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

PART 2 PRODUCTS

2.01 GENERAL

A. Unless otherwise noted, all motors 1/2 through 100 horsepower shall be rated 230/460 volt, 3 phase, 60 Hertz A.C.; motors 125 horsepower and above shall be rated 460 volt, 3-phase, 60 Hertz, and motors below 1/2 horsepower shall be rated 115/230 volt, 1 phase, 60 Hertz A.C.

B. All motors used with variable frequency drives shall be rated for inverter duty and shall be in accordance with NEMA MG1-2003, Part 31.

C. All motors shall be built in accordance with current NEMA, IEEE, ANSI and AFBMA standards. Motors shall be of the type and quality described by this Section and other Divisions of the Specifications, and/or as shown on the Drawings, fully capable of performing in accordance with Manufacturer's nameplate rating, and free from defective material and workmanship.

2.02 RATINGS

A. All motors shall be sufficient size for the duty to be performed and shall not exceed their full-rated load when the driven equipment is operating at specified capacity and over the operational range. Unless otherwise noted, motors driving pumps, blowers, etc. shall not be overloaded at any head or discharge condition. The motor shall not be required to deliver more than its rated nameplate horsepower, at the 1.0 service factor, under any condition of mechanical or hydraulic loading (i.e. although a 1.15 service factor is required, it may not be used under any condition).

B. Each motor shall develop ample torque for its required service throughout its acceleration range at a voltage 10 percent below nameplate rating. Where shown on the Electrical Drawings to be operated on a reduced voltage starter, the motor shall develop ample torque under the conditions imposed by the reduced voltage starting method.

C. All motors shall be continuous time rated suitable for operation in a 40 degrees C ambient unless noted otherwise.

D. Specific motor data such as Hp, rpm, etc., is specified under the detailed specification for the equipment with which the motor is supplied.

.2.03 NAMEPLATES

A. The motor manufacturer's nameplates shall be engraved or embossed on stainless steel and fastened to the motor frame with stainless steel screws or drive pins. Nameplates shall indicate

clearly all of the items of information enumerated in NEMA Standard MG1-10.38 or MG1-20.60, as applicable.

2.04 CONDENSATION HEATERS

A. Condensation heaters, where specified herein or under the detailed mechanical specifications shall be of the cartridge or flexible wrap around type installed within the motor enclosure adjacent to core iron. Heaters shall be rated for 120 Volt, single phase with wattage as required. The heater wattage and voltage shall be embossed on the motor nameplate.

2.05 WINDING TEMPERATURE DETECTORS

A. Winding temperature detectors, unless specified otherwise herein shall be a factory installed, embedded, bi-metallic switch type with leads terminating in the main conduit box. This device shall protect the motor against damage from overheating caused by single phasing, overload, high ambient temperature, abnormal voltage, locked rotor, frequent starts or ventilation failure. The switch shall have normally open contacts. Not less than three detectors shall be furnished with each motor.

2.06 POWER FACTOR CORRECTION CAPACITORS

A. The operating power factor of the motors shall range from 93 to 95 percent at full load and 95 to 98 percent when partially loaded. The capacitor current shall not exceed the motor no-load magnetizing current.

B. Capacitors shall be oil insulated or dry type (600 volt capacitors shall be of the dry type) with three high interrupting capacity current limiting integral fuse protection, blown fuse indicators, and discharge resistor and shall be hermetically sealed in steel enclosures. The insulating medium shall be nonflammable and meet the U.S. Environmental Protection Agency Standards. Covers shall be gasketed, bolt-on type. Capacitors shall be UL listed and NEMA rated and tested. Oil insulated type shall be non-PCB dielectric, biodegradable and low toxicity.

C. Units shall be designed to provide power factor correction in applications subject to the effects of harmonics as required for each installation. Where required, units shall consist of power factor correction capacitors as specified above and equipped with series inductors. The units shall be tuned to just below the 5th harmonic frequency on systems with predominately 3 Phase loads. Inductors shall have low flux density and distributed gaps, copper windings, brazed connections, winding varnish impregnated and baked, Class 220 degrees C insulation with 80 degrees C rise.

2.07 THREE PHASE INDUCTION MOTORS

A. Motors 50 horsepower and larger shall have a 120-volt space heater for moisture control.

B. Unless specifically noted in other Sections of these Specifications, all motors shall have minimum efficiencies as listed below:

Horsepower	NEMA Nominal Efficiency, %
1-2	84.0
3-5	88.5

7-1/2	89.5
10	90.2
15	91.0
20	92.0
25	92.2
30	92.4
40-50	94.0
60-100	94.5
Over 100	95.0

C. All motors 100 horsepower and larger shall be furnished with power factor correction capacitors located in the motor starter enclosure. The motor manufacturer shall provide suitable capacitors to the motor control center manufacturer unless otherwise noted. Power factor correction capacitors shall be provided only for the high-speed winding on a 2-speed motor. Power factor correction capacitors shall not be required for motors operating on variable frequency drives.

2.08 CONSTRUCTION

A. General:

1. All dripproof and weather protected Type I and Type II motors shall have epoxy encapsulated windings. Totally enclosed motors shall be provided with an upgraded insulation by additional dips and bakes to increase moisture resistance and shall not be encapsulated. Motors for outdoor service shall have vacuum pressure impregnated (VPI) epoxy insulation for moisture resistance. Two speed motors shall be of the two winding type.

2. Squirrel-cage rotors shall be made from high-grade steel laminations adequately fastened together and to the shaft, or shall be cast aluminum or bar-type construction with brazed end rings.

3. All motors shall be of the premium efficiency and high power factor type. All motors shall be the corrosion resistant type conforming to motors designated as "Corro-Duty" by U.S. Motors or equal.

4. Vertical motors shall be hollow or solid shaft as required by the equipment furnished under other Sections of these Specifications.

5. Totally enclosed non-ventilated (TENV) motors shall include the same ratings and accessories as specified for TEFC motors. Explosion-proof motors shall be UL listed and FM approved for Class 1, Division 1 hazardous areas.

B. Low Voltage, Three Phase Motors:

1. Motors shall be of the squirrel-cage induction type. Horizontal, vertical solid shaft, vertical hollow shaft, normal thrust and high thrust types shall be furnished as called for on the Drawings and as specified in other Sections of these specifications. Motors shall be of the type and quality described by these Specifications, and/or as shown on the schedule on the Drawings, fully capable of performing in accordance with Manufacturer's nameplate rating, and free from defective material and workmanship.

2. Motors shall have normal or high starting torque (as required), low starting current (not to exceed 650 percent full load current), and low slip.

3. Unless otherwise specified, motors shall be totally enclosed fan-cooled construction with a 1.15 service factor at the Class B Temperature-Rise.

4. The output shaft shall be suitable for direct connection or belt drive as required.

5. Motors shall have a Class F nonhygroscopic insulation system but shall be limited to Class B Temperature-Rise, at 1.15 service factor.

6. All motors shall have a final coating of chemical resistant corrosion and fungus protective epoxy fortified enamel finish sprayed over red primer over all interior and exterior surfaces. Stator bore and rotor of all motors shall be epoxy coated.

7. All fittings, bolts, nuts, and screws shall be Electropolished 316 stainless steel. Bolts and nuts shall have hex heads.

8. All machine surfaces shall be coated with rust inhibiter for easy disassembly.

9. Conduit box shall be split from top to bottom and shall be capable of being rotated to four 90 degree positions. Synthetic rubber-like gaskets shall be provided between the frame and the conduit box and sealed with a non-wicking, non-hygroscopic insulating material. A frame mounted pad with drilled and tapped hole, not less than 1/4-inch diameter, shall be provided inside the conduit box for motor frame grounding. All motor conduit boxes shall be provided with the correct number of conduit openings sized as indicated on the drawings. Boxes shall be suitably sized for conductor bending and terminations.

10. Totally enclosed motors shall be provided with condensate drain hole and epoxy coated motor windings to protect against moisture.

11. Nameplates shall be stainless steel. Lifting lugs or "O" type bolts shall be supplied on all frames 254T and larger. Enclosures shall have stainless steel screens. Motors shall be protected for corrosion, fungus and insects.

12. Low voltage, three phase motors shall be manufactured by U.S. Motors, Reliance Electric or Baldor.

13. Fractional Horsepower:

    a. Fractional horsepower motors shall be rigid, welded-steel, designed to maintain accurate alignment of motor components and provide adequate protection. End shields shall be cast iron or heavy fabricated steel. Windings shall be of varnish-insulated wire with slot insulation of polyester film, baked-on bonding treatment to make the stator winding strongly resistant to heat, aging, moisture, electrical stresses and other hazards.

    b. Motor shaft shall be made from high-grade, cold-rolled shaft steel with drive-shaft extensions carefully machined to standard NEMA dimensions for the particular drive connection.

c. For light to moderate loading, bearings shall be quiet all-angle sleeve type with large oil reservoir that prevents leakage and permits motor operation in any position.

d. For heavy loading, bearings shall be carefully selected precision ball bearings with extra quality, long-life grease, and large reservoir providing 10 years normal operation without relubrication.

14. Integral Horsepower:

a. Motor frames and end shields shall be cast iron or heavy fabricated steel of such design and proportions as to hold all motor components rigidly in proper position and provide adequate protection for the type of enclosure employed.

b. Windings shall be adequately insulated and securely braced to resist failure due to electrical stresses and vibrations.

c. The shaft shall be made of high-grade machine steel or steel forging of size and design adequate to withstand the load stresses normally encountered in motors of the particular rating. Bearing journals shall be ground and polished.

d. Rotors shall be made from high-grade steel laminations adequately fastened together, and to the shaft. Rotor squirrel-cage windings may be cast-aluminum or bar-type construction with brazed end rings.

e. Motors shall be equipped with vacuum-degassed anti-friction bearings made to AFBMA Standards, and be of ample capacity for the motor rating. The bearing housing shall be large enough to hold sufficient lubricant to minimize the need for frequent lubrication, but facilities shall be provided for adding new lubricant and draining out old lubricant without motor disassembly. The bearing housing shall have long, tight, running fits or rotating seals to protect against the entrance of foreign matter into the bearings, or leakage of lubricant out of the bearing cavity.

f. Bearings of high thrust motors will be locked for momentary upthrust of 30 percent downthrust. All bearings shall have a minimum B10 life rating of 5 years in accordance with AFBMA life and thrust values.

g. Vertical hollow-shaft motors will have nonreverse ratchets to prevent backspin. Non-reverse ratchets shall be suitable for duty with variable frequency drives.

C. Low Voltage, Single Phase Motors:

1. Single phase motors shall be split-phase and capacitor-start induction types rated for continuous horsepower at the rpm indicated on the drawings or as required by the specifications. Motors shall be rated 115/230 volts, 60 Hertz, single phase, open dripproof, or totally enclosed fan cooled as indicated on the drawings or as required by the specifications, with temperature rise in accordance with NEMA Standards for Class B insulation.

2. Totally enclosed fan cooled motors shall be designed for severe-duty.

3. Motors shall have corrosion and fungus protective finish on internal and external surfaces. All fittings shall have a corrosion protective plating.

4. Mechanical characteristics shall be the same as specified for polyphase fractional horsepower motors.

PART 3 EXECUTION

3.01 INSTALLATION

A. Motor Connections: All motors shall be connected to the conduit system by means of a short section 18-inch minimum of liquid tight conduit unless otherwise indicated. For all motor connections of No. 4 AWG or larger wire size, the Contractor shall install a grounding conductor in the conduit and terminate at main conduit box and at the motor control center or variable frequency drive with approved ground lugs and clamps.

B. Low Voltage: For wire sizes #8 AWG and larger, long barrel tin-plated copper compression (hydraulically pressed) type connections (Burndy Co., or equal) shall be installed on the branch circuit wires and the motor leads. Bolted connections shall utilize products which are rated for vibration applications (bolt, nut and spring washer). All connections shall be insulated with heavy duty heat shrinkable material (Raychem Corp. or equal).

3.02 TESTS AND CHECKS

A. The following tests shall be performed on all motors after installation but before putting motors into service.

1. The Contractor shall megger (1000 volts DC) each motor winding before energizing the motor, and, if insulation resistance is found to be low, shall notify the Engineer and shall not energize the motor. The following table gives minimum acceptable insulation resistance in megohms at various temperatures and for various voltages with readings being taken after one (1) minute of megger test run.

Degrees Winding Temperature		Voltage		
F	C	115 V.	230 V.	460V.
37	3.9	60	108	210
50	10	32	60	120
68	20	13	26	50
86	30	5.6	11	21
104	45	2.4	4.5	8.8
122	50	1	2	3.7
140	60	0.50	0.85	1.6

2. The Contractor shall check all motors for correct clearances and alignment and for correct lubrication, and shall lubricate if required in accordance with Manufacturer's instructions. The Contractor shall check direction of rotation of all motors and reverse connections if necessary. The correction for wrong rotational direction shall be made at the motor.

3. All tests shall meet the requirements of, but not be limited to, IEEE 43, 85 and 112. Efficiency tests for IEEE 112 shall include Method B.

4. The Contractor shall provide to the Engineer a typed list of all motors 1 HP and larger listing the no load motor current and voltage and the full load current and voltage. Any phase current imbalance greater than 10% shall be reported to the Engineer.

B. Field testing and commissioning shall be done in accordance with the latest revision of the "Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems" published by the InterNational Electrical Testing Association (NETA Standard ATS-2003).

END OF SECTION

SECTION 16191

MISCELLANEOUS EQUIPMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install all miscellaneous equipment as shown on the Drawings and as specified herein.

B. This Section provides the requirements for miscellaneous equipment typically employed in a facility, however, not all components specified in this Section are necessarily utilized on this project.

1.02 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01300 for approval by the Owner, detailed catalog information or drawings with sufficient detail to determine compliance with the specifications including describing electrical and physical characteristics of all equipment specified.

1.03 REFERENCE STANDARDS

A. Equipment enclosures shall have NEMA ratings suitable for the location in which they are installed, as specified in Section 16000.

PART 2 PRODUCTS

2.01 MATERIALS

A. Disconnect Switches

1. Disconnect switches shall be NEMA 4X heavy-duty, quick-make, quick-break, visible blades, 600 Volt, 3 Pole with full cover interlock, interlock defeat and flange mounted operating handle unless otherwise noted. All current carrying parts shall be copper.

2. NEMA 4X enclosures shall be stainless steel.

3. NEMA 7 enclosures shall be cast aluminum.

4. Lugs shall be copper.

5. All exterior hardware shall be stainless steel.

6. Switches shall be as manufactured by Cutler Hammer, Square D Company or General Electric Company or equal.

B. Fused Disconnect Switches

1. Fused disconnect switches shall be NEMA 4X heavy-duty, quick-make, quick-break, visible blades, 600 Volt, 3 Pole with full cover interlock, interlock defeat and flange

mounted operating handle unless otherwise noted. All current carrying parts shall be copper.

2. Fuses shall be rejection type, 600 Volts, 200,000 A.I.C., dual element, time delay, Bussman Fusetron, Class RK-5 or equal.

3. NEMA 4X enclosures shall be stainless steel.

4. NEMA 7 enclosures shall be cast aluminum.

5. Lugs shall be copper.

6. All exterior hardware shall be stainless steel.

7. Switches shall be as manufactured by Cutler Hammer, Square D Company or General Electric Company or equal.

C. Manual Motor Starters

1. Manual starters shall be furnished and installed for all types of single-phase motors. Manual starters shall be non-reversing, reversing or two speed type as required. NEMA sizes shall be as required for the actual horsepower of the motor furnished. Manual starters shall have motor overload protection in each phase. Built-in control stations shall be furnished as required or as shown on the Drawings.

2. NEMA 4X enclosures shall be stainless steel.

3. NEMA 7 enclosures shall be cast aluminum.

4. Manual motor starters shall be as manufactured by Cutler Hammer, Square D Company or General Electric Company.

D. Magnetic Motor Starters

1. Motor starters shall be 2 or 3 Pole, single or 3 Phase as required, 60 Hz, 600 Volt, magnetically operated, full voltage non-reversing unless otherwise shown on the Drawings. NEMA sizes shall be as required for the horsepower's shown on the Drawings.

2. Two speed starters shall be for single or two winding motors as required by the actual motor furnished or as shown on the Drawings.

3. Each motor starter shall have a 120 Volt operating coil, and control power transformer. Starters shall have motor overload protection in each phase. Auxiliary contacts shall be provided as required or as shown on the Drawings. A minimum of one N.O. and one N.C. auxiliary contacts shall be provided in addition to the contacts shown on the Drawings.

4. Overload relays shall be non-adjustable, ambient compensated and manually reset.

5. Control power transformers shall be sized for additional load where required. Transformer secondaries shall be equipped with time-delay fuses.

6. Built-in control stations and indicating lights shall be furnished as specified herein where shown on the Drawings.

7. NEMA 4X enclosures shall be stainless steel.

8. NEMA Type 7 enclosures shall be cast aluminum.

9. Magnetic motor starters shall be as manufactured by Cutler Hammer, Square D Company or General Electric Company or equal.

E. Control Stations and Indicators

1. Control stations shall be heavy-duty type, with full size (30.5mm) NEMA 4X or 7 operators, indicators, etc.

2. Indicators shall be full voltage and push-to-test type. Indicators located indoors shall be LED type and indicators located outdoors shall be incandescent lamp type.

3. NEMA 4X enclosures shall be stainless steel.

4. NEMA 7 enclosures shall be cast aluminum.

5. Control stations shall be Square D Company Class 9001, similar by Cutler Hammer or General Electric Company or equal.

F. General Purpose Dry Type Transformers

1. Transformers shall be dry type, two-winding with kVA and voltage ratings as shown on the Drawings.

2. Four full capacity taps shall be furnished, two 2-1/2 percent above and four 2-1/2 percent below rated primary voltage.

3. Maximum temperature rise shall be 80 degrees C. Windings shall be copper.

4. Transformers shall be built in accordance with ANSI C89.2 and NEMA ST-20.

5. Transformers shall be provided in NEMA 1 enclosures unless otherwise noted on the Drawings or as required by Section 16000. Where a NEMA 4X and/or stainless steel enclosure is required, the transformer shall be of the TENV type.

6. Transformers shall be furnished with hot dipped galvanized mounting hardware. Where a NEMA 4X and/or stainless steel enclosure is required, the hardware shall be 316 stainless steel.

7. Transformers shall be manufactured by the Square D Company or equal.

G. Mini Power-Zone Package Power Supply

1. Furnish and install, single-phase and three-phase general purpose individually mounted integral transformer and distribution centers of the two-winding type, self-cooled, with ratings and voltages as indicated on the drawings. Integral transformer and distribution centers shall be Mini-Power Center, as manufactured by Cutler Hammer, or Mini-Power Zone, as manufactured by Square D.

2. Integral transformer and distribution center shall have a main breaker, a transformer and a secondary panelboard with a main breaker.

3. Maximum temperature rise shall be 115 degrees C. Windings shall be copper.

4. Maximum ambient temperature shall be 40 degrees C.

5. Circuit breakers shall be bolt on type.

6. Enclosures shall be NEMA 12 for climate controlled electrical rooms and non process areas, and NEMA 4X stainless steel for damp, wet, corrosive and process areas.

7. Mini Power-Zone shall be U.L. listed.

8. Transformers shall be encapsulated using a sand-epoxy resin mixture to provide maximum protection against moisture, dust and corrosive environments.

H. Noise Isolation Transformers

1. Transformers shall be dry type, two-winding with kVA and voltage ratings as shown on the Drawings.

2. Furnish a minimum of four full capacity taps; two 2-1/2 percent above and two 2-1/2 percent below rated primary voltage.

3. Furnish electrostatic shielding and "spike" suppression.

4. Maximum temperature rise shall be 80 degrees C. Windings shall be copper.

5. Transformers shall be furnished with hot dipped galvanized mounting hardware.

6. Transformers shall be General Electric Company's "Guard II"; Topaz "Ultra-Isolator" or equal.

I. Transient Voltage Surge Protection

1. Lightning and surge protection shall be as manufactured by Advanced Protection Technologies or equal. Models based on voltage and phase shall be:

a.	TE/1HP	120/240 volt, single phase
b.	TE/11HP	120 volt, single phase
c.	TE/12HP	240 volt, single phase
d.	TE/2HP	120/208 volt, three phase
e.	TE/3HP	120/240 volt, three phase
f.	TE/4HP	277/480 volt, three phase
g.	TE/5HP	480 volt, three phase

J. Wireway

1. NEMA 1 wireway shall be gasketed painted steel with stainless steel screw covers.

2. NEMA 4X wireway shall be 316 stainless steel with gasketed clamped covers.

3. NEMA 1 wireway shall be Square-Duct as manufactured by the Square D Co.; NEMA 4X shall be Bulletin F-22 as manufactured by the Hoffman Engineering Co. or equal.

K. Control Relays

1. Control relays shall be heavy duty machine tool type, with 10 Amp, 300 Volt convertible contacts. Number of contacts and coil voltage shall be as shown on the Drawings. General use relays shall be Square D Company, Class 8501 Type X, similar by; Cutler-Hammer, Allen-Bradley Company or General Electric Company. Latching relays shall be Square D Company, Class 8501 Type X, similar by; Cutler-Hammer, Allen-Bradley Company or General Electric Company or equal.

2. Time delay relays shall be electronic, 600 Volt, 20 Amp contacts, with calibrated knob operated adjustment and numerical time dial. On delay and off delay types and timing ranges shall be as shown on the Drawings or as required for proper operation of the actual equipment furnished. Relays shall be Agastat Model 7012 or 7022 or equal.

L. Polyethylene Warning Tape

1. Warning tape shall be red polyethylene film, 6-in minimum width.

2. Warning tape shall be W.H. Brady Co., Catalog No. 91296 or equal.

M. Terminal Blocks

1. Terminal blocks shall be 600 Volt, channel mounted, with tubular screw and pressure plate.

2. Terminal blocks shall be Bulletin 1492-CA1 as manufactured by the Allen-Bradley Co. or equal.

N. JIC Boxes for GF Receptacles

1. JIC boxes shall be 6-inches x 6-inches x 4-inches aluminum continuous hinge clamp cover boxes, Hoffman Catalog Number A-606 CHAL with Type L23 stainless steel fast operating JIC clamp, or equal.

2. Install 1-1/2-inch bushings in bottom of box for cord and plug to pass through.

O. Corrosion Inhibitors

1. All equipment enclosures, terminal boxes, etc, located in a NEMA 4X rated area (where shown on the Drawings) that contains electrical or electronic equipment or terminal strips shall be furnished with an internally mounted, chemically treated corrosion inhibitor pad.

2. The corrosion inhibitor pads shall be as manufactured by Hoffman Engineering Co.; 3M or equal.

P. Equipment Mounting Stands

1. Equipment mounting stands shall be custom fabricated from 1/4-in 316 stainless steel plate and 3-in 316 stainless steel channel, unless otherwise shown on the Drawings.

2. All hardware shall be 316 stainless steel.

Q. Terminal Cabinets:

1. Interiors shall be so designed that control relays and terminal blocks can be replaced or added without disturbing adjacent units. Each cabinet shall be furnished with a minimum of 50 spare terminals.

2. All interiors shall be completely factory assembled with control relays, terminal blocks, insulating barriers, etc. All 120 volt AC and DC terminal blocks shall be isolated from each other by insulating barriers or separate enclosures.

3. All wiring within the cabinets shall be grouped together in harnesses and secured to the structure.

4. All shielded cables shall terminate in separate cabinets. A third terminal shall be provided for each twisted shielded pair and the shield for each connected thereto, unless otherwise noted on manufacturer's shop drawings.

5. Terminal blocks shall be tubular screw type with pressure plates and shall be rated 600 volts. Terminal blocks shall be Allen Bradley Catalog Number 1492-CA1 or equal.

6. Boxes shall be made from 14 gauge galvanized steel and shall be of sufficient size to provide a minimum of 4 inches of wiring space on all sides and between adjacent terminal blocks. A minimum 2-inch spare shall be provided between control relays. A minimum of four mounting studs shall be provided on each cabinet. Cabinets shall be furnished without knockouts. Holes for raceways shall be drilled on the job.

7. A single or double hinged door shall cover the front of each terminal cabinet. Doors shall have a neoprene gasket, vault type handle, three point catch and lock. Two keys shall be supplied for each lock. All locks shall be keyed alike. A terminal block schedule shall be provided with each terminal point numbered and identified (typewritten) as to function.

8. All exterior and interior steel surfaces of the cabinets shall be properly cleaned and finished with ANSI 61 grey over a rust-inhibiting phosphatized coating conforming to ANSI A55.1. The finish paint shall be of a type to which field applied paint will adhere.

9. Cabinets in wet, damp, corrosive and all outdoor locations shall be NEMA 4X 316 stainless steel.

10. Cabinets shall be Hoffman Engineering Company with latch kit hardware or be an equal product.

R. Emergency Shower Alarm Horn and Light

1. Emergency shower alarm horn shall be vibrating type for 120 Volts, 60 Hz and shall be Federal Signal Corp.; Catalog No. 350+WB for surface mounting, Catalog No. 350+FG+FB for flush mounting, similar by Benjamin Co.; Edwards Co. or equal.

2. Emergency shower alarm light shall be a flashing strobe unit with red fresnel globe, for use on a 120 Volts, 60 Hz power supply, and shall be Benjamin Catalog No. KL-4011-120, similar by Federal Signal; Edwards Co. or equal.]

S. Intrinsically Safe Relays

1. Intrinsically safe relays shall be solid state type with 5 Amp output contacts, suitable for use on a 120 Volt, 60 Hz power supply and shall be FM approved for pilot devices in Class I, Division 1, Group D hazardous atmospheres.

2. Intrinsically safe relays shall be Gems Solid State Safe-Pak as manufactured by Gems Sensors, Division of Transamerica Delaval, Inc. or equal.

T. Lighting Contactor

1. Lighting contactor shall be of the electrically operated, mechanically held type mounted in NEMA 1, enclosures (except where noted otherwise on the Drawings) with number of poles as noted on the Drawings. Operating coils shall be rated for 120 Volts unless otherwise indicated on the Drawings and shall be for momentary operation. Provide with "Hand Off-Auto" switch on cover where shown on the Drawings.

2. Contactors shall be rated for 20 Amps, 600 VAC and shall be Automatic Switch Co., Bulletin 917 RC, similar by Square D Co.; Cutler Hammer/Westinghouse or equal.

U. Beacon Alarm Light

1. Beacon alarm light for building exterior mounting shall be flush mounted, weatherproof construction and have a 750,000 candlepower xenon strobe tube and red polycarbonate lens. Beacon alarm light shall be Federal Signal, Model 371 DST.

V. Alarm Horn and Light

1. Alarm horn shall be vibrating type for 120 volts, 60 Hertz and shall be Federal Signal Corp. Cat. No. 350 + WB for surface mounting, Federal Signal Corp. Cat. No. 350+FG+FB for flush mounting, equal by Benjamin Co. or Edwards Co. or equal.

2. Alarm light shall be a NEMA 4X flashing strobe unit with red glass globe, for use on a 120 volts, 60 Hertz power supply, and shall be Federal Signal Co. Model 191X, or equal.]

W. 24-Hour Programmable Timers

1. Unless otherwise specified, time switches shall be of the programmable type capable of being programmed at the intervals as noted on the Drawings over a 24-hour day. Program tabs shall be easily set by hand without tools to obtain or to change the desired programming schedule. The switching condition shall be maintained when adjacent tabs are set alike.

2. The unit shall be powered by a self-starting, enclosed, 120 Volt, synchronous motor capable of continuous accurate operation. A reserve power, precision wound spring and

associated escapement device shall be integrally mounted to maintain time settings during power failures of up to 24 hours.

3. The switch mechanism shall be a self-contained unit rated at not less than 20 Amps, 120 Volts, single pole, double throw and shall be readily replaceable in the field.

4. An omitting device shall be furnished as an integral part of the time switching operation to be skipped for any preselected day or days of the week.

5. Unless otherwise specified, time switches shall be as manufactured by Intermatic; Tork; Paragon or equal.

X. Power Monitors (Digital Power Monitor)

1. Microprocessor based metering: At each circuit location shown on the Drawings, furnish a digital microprocessor based metering device capable of monitoring and displaying the functions listed below. The device shall provide the status input functions indicated and the capability to communicate data to a centralized monitoring system via a data highway network. The device shall be UL listed. The device shall be IQ Analyzer Plus type as manufactured by the Cutler Hammer or equal.

2. Metering Functions

a. The Digital AC Instrumentation Package shall be capable of measuring, calculating and directly displaying on the front panel display the following information:

1) Volts on each phase plus average of all three phases

2) Current on each phase plus average of all three phases

3) Neutral or ground current

4) Frequency

5) Power Factor

6) KVA

7) KVAR

8) KW

9) Total KWH as an accumulating total, providing bi-directional (import/export) indication

10) Total KVARH as an accumulating total, providing bi-directional (import/ export) indication

11) Amps Demand.

3. Monitoring and Control Functions

a. Provide eight self-powered digital status inputs to monitor the following points:

1) Circuit breaker OPEN status

2) Circuit breaker CLOSED status

3) Circuit breaker TRIPPED status

4) Circuit breaker OUT OF SERVICE (withdrawn) status.

b. Provide one auxiliary analog input rated 1.0 VAC/VDC nominal full scale input which can be used to measure an external variable such as transformer temperature, air temperature, or battery voltage.

c. Provide one auxiliary analog output (selectable 0-20ma or 4-20ma) proportional to any measure parameter.

d. Provide three Form C dry contact control relay outputs rated 277 VAC or 30 VDC at 10 Amp maximum load current, that can each function as:

1) Setpoint relays that operate as a function of any measured parameter for demand, power factor, or load control. Seventeen programmable setpoints shall each have programmable operate and release limits and time delays on operate and release. Relays shall provide selectable pulse mode or tach mode operation.

2) Remote control relays operated by commands via the communications port.

3) Breaker trip relay (over/under volt, volt unbalance, phase reversal, current unbalance, over/under frequency).

4) KWH or KVARH pulse output relay.

5) Alarm relays.

4. Operational Features

a. Provide the following operating features:

1) True RMS measurements.

2) Connect directly to PT's and CT's for systems over 600 volts.

3) Provision for a fourth current input for measurement of ground or neutral current.

4) 300 amp, one second surge protection on all four current inputs.

5) 3-field, 20 character, high visibility 0.4-in character height vacuum-fluorescent display with a programmable time out feature.

b. Store in non-volatile memory the following:

1) A time-stamped alarm and event log of up to 50 events which records event date, time (to 1 second), event type and value for all over/under limit conditions,

all status input activity and all relay operations. Log shall be read via the communications port.

2) A time-stamped minimum/maximum log, which records the value of any parameter exceeding the previous highest or lowest value recorded. Log shall be read from the front panel display or via communication port.

3) A time-stamped snapshot (historical) log, with a 100 snapshot capacity and user-definable snapshot interval from 1 second to 400 days which records snapshot values for Average Volts, Average Amps, KW, KVAR, KW Demand, Power Factor, Frequency, KWH, KWH Reverse, KVARH and Auxiliary Volts Input. Log shall be read via the communications port.

4) All setup data.

5. The device shall be field programmable as follows:

a. Volts scale, volts mode (wye, delta, single phase), amps scale, Vaux scale, baud rate and the relay operation shall be programmable from the front panel.

b. All parameters above, plus additional alarm/event parameters shall be programmable via the communications port using a portable terminal or a computer.

c. The programming shall be password protected.

6. Waveform Capture

a. Provide waveform capture capability allowing any of the eight voltage and current input channels to be digitally sampled at 256 samples/60 Hz cycle. Waveform capture shall be initiated using commands made via the communications port. Waveform capture data shall be mad accessible via the communications port.

7. Data Communications

a. Provide a serial communication port which has:

1) Switchable RS-232C and RS-485 capability.

2) Addressable polling of multiple units.

3) Packet transmission.

4) Selectable transmission at 300 to 19,200 baud.

b. Provide all communication cables to interconnect monitors within the electrical equipment.

8. All necessary cables, connectors, software, hardware, etc. shall be provided as required to interface with a computer system and/or related PLCs as specified herein or in other Sections and Divisions of the specifications.

Y. Power Monitoring Software

1. The Manufacturer shall supply PMCS application software which provides the operator user friendly access to all Circuit Monitor data, breaker/contactor/switch status and manual control, communication alarms, captured waveforms and logged data. The Manufacturer shall coordinate and make all provisions required for this software to operate with the system and software specified in Division 13.

2. In addition to the PMCS application software programs, each PCW shall permit the user of other MSDOS-based programs as desired by the user.

3. Application Software shall be supplied by the electrical equipment manufacturer to support system configuration, monitoring of the devices, data logging, alarming, and other operations associated with the PMCS. The software provided shall include the following software options.

    a. Pre-configured screen displays for displaying data from the Circuit Monitors, Electronic Trip Units, and Transformer Temperature Monitors.

    b. Data logging function which prints power monitoring device data to printer or stores it to disk file at user-specified intervals; logging intervals between 1 and 60 minutes in increments of 1 minute must be supported.

    c. Graphically display the voltage waveforms, current waveforms, and residual waveforms captured from Circuit Monitors, and support their storage to disk for later waveform analysis.

    d. Report status of Circuit Monitor inputs and outputs, status of Transformer Temperature Monitor relays (fan, alarm, and emergency shutdown), and Electronic Trip Unit status.

    e. Resets of values device quantities such as accumulated energy, peak demand, historical data, etc.

    f. Device setup, diagnostics, and system communication test.

    g. Microsoft Windows XP (or higher) application designed to monitor the entire system of power monitoring devices in the background for alarms, events, and data logging, allowing the operator to perform other tasks with the workstation.

    h. Display information from the PMCS in a variety of standard formats including real time tables, historical tables, bar charts, analog meters, waveform plots, and time trend plots.

    i. Log PMCS data to printer and hard disk at user-specified intervals and provide exporting functions to allow usage of the logged by other software products.

    j. Color-coded alarms for digital quantities and analog quantities each with user-selectable indication including visual, audible, and/or required acknowledgement, additionally, multi-level alarms shall be supported for analog quantities.

    k. Events shall be recorded in an Event Log file which shall be capable of holding at least 1000 events, the date/time of the event, and a descriptive text.

l. Report the status of Circuit Monitor inputs and outputs, Transformer Temperature Monitor relays (fan, alarm, and emergency shutdown relays), Electronic Trip Units status, status I/O associated with programmable logic controllers, etc.

m. Graphical waveform displays for the voltages, phase currents and residual current monitored by Circuit Monitors.

n. Include harmonic information in the graphic waveform displays for Circuit Monitors including Total Harmonic Distortion (THD), RMS magnitudes, peak values, Crest Factors (CF), magnitudes of the individual harmonics, Telephone Interference Fact or (TIF), etc.

o. Standard reports to simplify routine printouts of various data formats.

p. Password protected resets accumulated real, accumulated reactive energy, energy management alarms, minimum and maximums, and other circuit quantities associated with the power monitoring devices.

q. Provisions for creating Custom Tables to display circuit information and the ability to easily modify them as the need arises.

r. The user shall be able to develop reports which include standard and custom tables, historical data, time trend plots, and other display formats; the reports shall be complete with headers, footers, date/time of the report, and page numbering, and may be modified by the user.

s. The PMCS software shall include a Macro Language with a timer for executing a specified (scheduled) macro such as printing a report, on a scheduled basis.

t. Password protected control of system operations from the personal computer including the operation of CM Outputs, PLC outputs, Electronic Trip Units, and other compatible devices.

u. The software must display real-time information from the power monitoring devices on any type of drawing including power one-line system drawings, equipment elevation drawings, shop floor layouts, legends, process drawings, etc.

v. It shall be possible to display any of the quantities available from the power monitoring devices or programmable logic controllers in the location, size, and color selected by the user.

w. The Interactive Color Graphics software shall allow the user to zoom, scale, and scroll the drawings to the desired degree of magnification.

x. The software shall be capable of displaying status of circuit breakers (open/closed/tripped), status of transformer fans (on/off), transformer coil and motor temperatures, power factor capacitors (on/ off), starter positions and any other information available on the PMCS network.

y. From within any drawing the user shall have the ability to display drawings in a hierarchical fashion to allow quick access to related drawings.

z. The software shall include provisions for spectrum plots, power spectral densities, FFT's, and other operations which aid in analyzing power quality in the system, de-rating factors, equipment diagnostics, etc.

aa. Waveform Analysis Software shall be provided which can be used to analyze, organize the archive waveform information that will be acquired using the PMCS.

bb. The Interactive Color Graphics software shall allow the user to manually control various system operations with proper password entry (eg. load transformer).

4. The electrical equipment manufacturer shall include a 3 year Software Service Agreement which provides customer with software upgrades for the software specified above as they are available.

Z. Control System

1. The Manufacturer shall provide a complete and fully functional control system to manually or automatically operate the control system as specified herein and in other applicable sections of these specifications. All Manufacturers recommended safety devices shall be furnished to protect operators. All control devices, unless specified otherwise, shall be mounted in the Control Panel.

AA. Control Panel Construction

1. The control panel shall consist of a main circuit breaker, a motor circuit protector (MCP) and magnetic starter for each motor, and a 120-volt control power transformer (fused on primary and secondary). All control components shall be mounted in one common enclosure. Control switches shall provide means to operate each motor manually or automatically.

2. Unless specifically noted otherwise, the electrical control equipment shall be mounted within a NEMA 4X enclosure, constructed of not less than 14 gauge 316 stainless steel. Latches shall be quarter turn quick release type and all hardware shall be 316 stainless steel. Where NEMA 3R or 12 enclosures are specifically required, the door shall be provided with a pad-lockable vault type 3-point latch. The enclosure shall be equipped with a door and shall incorporate a removable back panel on which control components shall be mounted. Back panel shall be secured to enclosure with collar studs. Door(s) shall be interlocked with main circuit breaker and provided with pad-locking provision.

3. All motor branch circuit breakers, motor starters and control relays shall be of highest industrial quality, securely fastened to the removable back panels with screws and lock washers. Back panels shall be tapped to accept all mounting screws. Self-tapping screws shall not be used to mount any component.

4. A thermal-magnetic air circuit breaker, Type FH as manufactured by the Square D Company, or equal, shall be furnished for the main breaker. All circuit breakers shall be sealed by the manufacturer after calibration to prevent tampering. Each circuit breaker shall be adequately sized to meet the equipment operating conditions. Motor Circuit Protectors (MCP) shall be molded case with adjustable magnetic trip only, "Mag-Gard" as manufactured by the Square D or equal.

5. Reduced voltage auto transformer: Auto-transformer type with closed circuit transition. Auto-transformers shall be dry type with 50, 65 and 80 percent voltage taps and over-

temperature protection. Timing relays shall be pneumatic, adjustable. Relay settings shall be approximately 75 percent of relay range. Starters shall be manufactured by Siemens or Square D.

6. Auxiliary contacts shall be provided for remote run indication and indication of each status and alarm condition. Additional controls shall be provided as specified herein and as required by Divisions 13, 16 and as shown on the drawings.

7. All operating control and instruments shall be securely mounted on the exterior door. All controls and instruments shall be clearly labeled to indicate function. All exterior mounted equipment shall be NEMA 4X.

8. Mode selector switches shall be Hand-Off-Auto type to permit override of automatic control and manual actuation of shutdown. Switches shall be NEMA 4X (800H) as manufactured by Allen-Bradley, or equal, providing three (3) switch positions, each of which shall be clearly labeled according to function.

9. Indicator lamps shall be LED (indoors) or Incandescent (outdoors) full voltage type and mounted in NEMA 4X (800H) modules, as manufactured by Allen-Bradley. Lamp modules shall be equipped to operate at 120 volt input. Lamps shall be easily replaceable from the front of the control compartment door without removing lamp module from its mounted position. Indicators shall be provided for individual motor run and an indicator for each failure condition.

10. A six (6) digit, nonreset elapsed time meter shall be connected to each motor starter to indicate the total running time of each motor in "hours" and "tenth of hours". The elapsed time meters shall be Series T50 as manufactured by the ENM Company or equal.

11. A failure alarm with horn and beacon light shall be provided. Silence and reset pushbuttons shall also be furnished. A common failure reset pushbutton shall be provided to reset the alarm conditions (reset shall occur only if fault condition has been cleared). The alarm horn shall be weatherproof rated with gasket (Federal Signal Corporation, Cat. #350 or equal). The alarm beacon shall be NEMA 4X rated, red lense and solid state flasher (Ingam Products Inc. LRX-40).

12. The control panel shall operate on a power supply of 480 volts, 3-phase, 60 hertz unless otherwise noted.

13. The control diagrams and overload tables shall be laminated to the inside of the door except where door space is limited the laminated documents shall be in the print storage pocket.

14. Print storage pockets shall be provided on the inside of each panel. Pocket shall be of sufficient size as required to hold all prints necessary to service the equipment. A set of reduced drawings shall be provided for each panel, fixed to fit in the storage pocket.

15. A duplex GFCI utility receptacle (circuit breaker protected) providing 120 volts, 60 Hertz, single phase current shall be mounted on the side of the enclosure.

16. The control panel shall include an adjustable time delay relay to prevent any two motors from starting simultaneously. All timing relays shall be solid state, with pin (octal) and bases, relays shall be T-series as manufactured by Diversified Electronics Inc. or equal.

17. Alternators shall be provided to sequence motors, alternators shall be 008-120-13SP or 009-120-23AP as manufactured by Sta-con, or equal.

18. A phase monitor shall be provided for the control panel, monitors shall be model SUA-440-ASA as manufactured by Diversified Electronics Inc., or equal.

19. All exterior mounted equipment shall be rated NEMA 4X. Hinged NEMA 4X 316 stainless steel viewing windows will be permitted where such equipment is not available with a NEMA 4X rating.

20. The control panel shall be provided with lightning and surge protection. Protection devices shall be mounted within the control panel enclosure. Lead lengths shall not be longer than 12 inches from the main circuit breaker. Protection shall be as manufactured by Advanced Protection Technologies (APT) for the power supply voltage:

    a. TE/5HP - 480 VAC, 3-Phase

    b. TE/4HP - 480/277 VAC, 3-Phase

    c. TE/3HP - 120/240 VAC, 3-Phase

    d. TE/2HP - 120/208 VAC, 3-Phase

    e. TE/1HP - 120/240 VAC, 1-Phase

21. All control panel wiring shall be numbered at both ends with type written heat shrinkable wire markers.

22. Wiring shall be stranded copper, minimum size #14 AWG (except for shielded instrumentation cable), with 600 volt, 90 degree C, flame retardant, Type MTW thermoplastic insulation.

23. The control panel shall be provided with nameplates identifying each component, selector switches, pilot lights, etc.. Nameplates shall be permanently affixed using an epoxy process (inner door nameplates shall be fastened with stainless steel screws). Nameplates shall be laminated plastic, engraved white letters with a black background.

24. All control panels shall be provided with a master nameplate located on the exterior door.

25. Where applicable provide a nameplate which reads as follows "CAUTION - THIS PANEL CONTAINS A VOLTAGE FROM AN EXTERNAL SOURCE." Letters shall be black on a high visibility yellow background.

26. Corrosion Inhibitor Emitter: Inclusion of an industrial corrosion inhibitor emitter that shall protect internal components of control panel from corrosion for up to one year. One spare emitter shall be provided for each control panel.

27. All control relays shall be have 10 amp rated contacts (minimum), 11 pin with mounting base , 3PDT (minimum), with LED indicators to show relay status, relays shall be manufactured by Potter Brumfield or equal.

28. Terminal blocks shall be 600 volt heavy duty rated, tubular clamp type. Terminal strips shall be Allen Bradley catalog #1492-CA-1 or equal. Each terminal shall be individually labeled.

29. The completed control panel assembly shall be U.L. certified.

30. Intrinsically safe relays shall be solid state type with 5 amp output contacts, suitable for use on 120 volt, 60 hertz power supply and shall be Factory Mutual approved for devices in Class 1, Division 1 hazardous atmospheres. Intrinsically safe relays shall be Gems Solid State Safe-Pak as manufactured by Gems Sensors, Division of Transamerica Delaval, Inc. or equal.

31. All electronic control equipment (i.e. controllers, isolators, signal boosters, transmitters, PLC's, etc) shall be as specified in Division 13.

32. A copper ground bar with sufficient terminals for all field and panel ground connections shall be provided.

33. All signal wiring entering and exiting the control panel shall be provided with surge protection. Surge protection shall be as specified in Division 13.

34. An 8-inch (minimum) clear space within the enclosure shall be provided horizontally along the entire top and bottom of the control panel. A 4-inch (minimum) clear space within the enclosure shall be provided vertically along the entire sides of the control panel. No devices, terminals, etc. shall be installed within this space, the space shall be provided for field conduit and wiring access only.

35. All wiring within the control panel shall be color coded or coded using electrical tape in sizes where colored insulation is not available. The following coding shall be used. For different system voltages, the color coding shall be as required by the Engineer.

System	Wire	Color
480Volts 3 Phase	Ground	Green
	Neutral (As Required)	White
	Phase A	Brown
	Phase B	Orange
	Phase C	Yellow
Control (Individual Conductors)	AC	Red
	DC	Blue
	Foreign	Yellow

36. See instrument drawings and specifications for remote control and monitoring interface requirements to the plant control system.

BB. Spare Parts

1. The following number of spare parts shall be furnished for each control panel.

   a. 1 Indicator light assembly

b. 2 control relays for each type furnished

c. 5 fuses for each type/size furnished

d. 1 set thermal overloads for each size furnished

e. 1 selector switch for each type furnished

f. 1 starter coil for each size furnished

PART 3 EXECUTION

3.01 INSTALLATION

A. Mounting Stands

1. Field mounted disconnects, pushbutton control stations, etc, shall be mounted on 316 stainless steel stands as specified herein or as shown on the Drawings. Where clearance requirements for stands may not be maintained, the Engineer may direct equipment to be wall-mounted adjacent to the motor or device, but in no case shall the distance from the motor or device to the control station exceed 3-ft.

END OF SECTION

SECTION 16500

LIGHTING SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install complete lighting systems including panelboards, transformers, lighting fixtures, receptacles, switches, contactors, and all necessary accessories and appurtenances required as hereinafter specified and shown on the Drawings.

1.02 STANDARDS

A. All lighting fixtures shall be in accordance with the National Electrical Code and shall be constructed in accordance with the latest edition of the Underwriters Laboratories "Standards for Safety, Electric Lighting Fixtures." All lighting fixtures shall be Underwriters Laboratories labeled.

PART 2 PRODUCTS

2.01 MATERIALS

A. Panelboards shall be as specified under Section 16470.

B. Transformers shall be as specified under Section 16191.

C. Conduit shall be as specified under Section 16110.

D. Wire shall be as specified under Section 16120.

E. Switches

1. Wall switches shall be of the indicating, toggle action, flush mounting quiet type. All switches shall conform to Federal Specification WS896-E.

2. Wall switches shall be of the following types and manufacturer or equal.

   a. Single pole - Arrow-Hart, Catalog Number 1991, or equal by Harvey Hubbell, Inc., Pass & Seymour, Inc., or equal.

   b. Double pole - Arrow-Hart, Catalog Number 1992, or equal by Harvey Hubbell, Inc., Pass & Seymour, Inc., or equal.

   c. Three way - Arrow-Hart, Catalog Number 1993, or equal by Harvey Hubbell, Inc., Pass & Seymour, Inc., or equal.

   d. Four way - Arrow-Hart, Catalog Number 1994, or equal by Harvey Hubbell, Inc., Pass & Seymour, Inc., or equal.

   e. Single pole, key operated - Arrow-Hart Catalog Number 1991-L, or equal.

f. Single pole, pilot indicating - Bryant Catalog Number 4901-PLR120, or equal by Harvey Hubbell, Inc., Pass & Seymour, Inc., or equal.

g. Momentary contact, 2 circuit, center off - Arrow-Hart, Catalog Number 1895, or equal by Harvey Hubbell, Inc., Pass & Seymour, Inc., or equal.

h. Fluorescent dimmer switch for 120 volt control of 2 to 12 F40 lamps. Prescolite Control Catalog Number D56F or equal as manufactured by Lutron Electronics, Valmont/ Hunt Electronics, or equal.

i. Weatherproof cover for standard toggle switches - Crouse-Hinds Catalog Number DS181, or equal by Appleton Electric Co., L.E. Mason Co., or equal.

j. Explosion-proof single pole switches shall be for 20 amperes, 120/277 volts, mounted in cast boxes and be similar and equal to Crouse-Hinds EDS Series, or equal by Appleton Electric Co., L.E. Mason Co., or equal.

F. Receptacles

1. Receptacles shall be of the following types and manufacturer or equal. Receptacles shall conform to Federal Specification WC596-F.

a. Duplex, 20A, 125V, 2P, 3W; Arrow-Hart, Catalog Number 5362, or equal by Harvey Hubbell, Inc., Pass & Seymour, Inc., or equal.

b. Weatherproof or corrosion resistant single, 20A, 125V, 2P, 3W; with cover Crouse-Hinds Co., Catalog Number WLRS-5-20, or equal by Harvey Hubbell, Inc., Pass & Seymour, Inc., or equal.

c. Weatherproof or corrosion resistant duplex, 20A, 125V, 2P, 3W; with cover Crouse-Hinds Co. Catalog Number WLRD-5-20, or equal by Harvey Hubbell, Inc., Pass & Seymour, Inc., or equal.

d. Ground fault interrupter, duplex, 20A, 125V, 2P, 3W; Arrow-Hart Catalog Number GF 5342, or equal by Harvey Hubbell, Inc., Pass & Seymour, Inc., or equal.

e. Duplex, 20A, 125V, 2P, 3W with transient voltage surge suppressor and indicator light; Pass & Seymour Catalog 6362-GRY-5P, equal by Harvey Hubbell Inc., Bryant Electric Co., or equal.

f. Stainless steel indoor mounting plate for G.F.I. receptacle; Arrow-Hart Catalog Number 97061, or equal by Harvey Hubbell, Inc., Pass & Seymour, Inc. or equal.

g. Weatherproof cover for G.F.I. receptacle in FS box; Arrow-Hart Catalog Number 4501-FS, or equal by Harvey Hubbell, Inc., Pass & Seymour, Inc., or equal.

h. Explosion-proof, 20A, 125V, 2P, 3W; Appleton Electric Co. Catalog Number EFS175-2023 or EFSC175-2023 or equal by Crouse-Hinds Co., Killark Electric Manufacturing Co., or equal. Furnish one Appleton Electric Co. Catalog Number ECP-1523 cap or equal by Crouse-Hinds Co., Killark Electric Manufacturing Co., or equal for every two receptacles (minimum of one).

i. Single, 20A, 250V, 2P, 3W; Arrow-Hart Catalog Number 5861, or equal by Harvey Hubbell, Inc., Pass & Seymour, Inc., or equal.

j. Single, 30A, 125V, 2P, 3W; Arrow-Hart Catalog Number 5716; cap: Arrow-Hart Catalog Number 5717.

k. Single, 30A, 250V, (3 phase) 3P, 4W; Arrow Hart Catalog Number 8430N; Cap: Arrow-Hart Catalog Number 8432AN.

G. Device Plates

1. Plates for flush mounted devices shall be of the required number of gangs for the application involved and shall be 302 (18-8) high nickel stainless steel of the same manufacturer as the device.

2. Plates for surface mounted device boxes shall be of the same material as the box.

H. Lighting Fixtures

1. Lighting fixture types shall be as shown on the "Lighting Fixture Schedule" on the Drawings. The catalog numbers listed are given as a guide to the design and quality of fixture desired. Equivalent designs and equal quality fixtures of other manufacturers will be acceptable.

I. Lamps

1. Fluorescent lamps shall be medium bi-pin and recessed double contact, rapid start, standard cool white and biaxial types all as shown on the "Fixture Schedule."

2. Fluorescent ballasts shall be energy saving, Class P, rapid start, high power factor, CBM certified by E.T.L. and listed by Underwriters Laboratories, Inc., for operation on 120 volts or as shown on the "Lighting Fixture Schedule." Ballasts shall have ballast efficiency factors (BEF) of: 1.805 for 1-F40T12 lamp and 1.060 for 2-F40T12 lamps.

a. Ballasts for two (2) F40 (430 MA) lamps shall be similar and equal to Advance Transformer Co., Mark III equal by MagneTek Universal Manufacturing, Holophane Lighting, or equal.

3. Mercury vapor lamps shall be deluxe white of the size and type as shown on the "Lighting Fixture Schedule."

4. Mercury vapor ballasts shall be of the constant wattage auto-transformer type of the correct size and voltage for the fixture it is to serve as shown on the "Lighting Fixture Schedule." All ballasts shall be as manufactured by Holophane Lighting, MagneTek Universal, Advance Transformer Company, or equal.

5. High pressure sodium lamps shall be clear and of the size and type as shown on the "Lighting Fixture Schedule."

6. High pressure sodium ballasts shall be of the constant wattage high power factor type of the correct size and voltage for the fixture it is to serve as shown on the "Lighting Fixture

Schedule." All ballasts shall be as manufactured by Advance Transformer Co., Holophane Lighting, MagneTek Universal Manufacturing, or equal.

7. Metal halide lamps shall be clear and of the size and type as shown on the "Lighting Fixture Schedule."

8. Metal halide ballast shall be of the constant voltage auto-transformer type of the correct size and voltage for the fixture it is to serve as shown on the "Lighting Fixture Schedule." All ballasts shall be as manufactured by Holophane Lighting, MagneTek Universal Manufacturing, Advance Transformer Co., or equal.

9. Incandescent lamps shall be inside frosted, extended service, 2500 hour life with medium base.

10. All lamps shall be of one manufacturer and shall be as manufactured by Sylvania Electric Products, Inc., General Electric Co., North American Philips Lighting Corp., or equal.

J. Flexible Fixture Hangers

1. Flexible fixture hangers used in non-hazardous areas shall be type ARB and flexible fixture supports used in hazardous areas shall be type ECHF as manufactured by the Crouse - Hinds Co., Appleton Electric Co., Killark Electrical Manufacturing Co., or equal.

K. Vapor-Tight Handlamp

1. A vapor-tight handlamp with reflector shall be furnished complete with 50 foot cord and grounding plug. The handlamp shall be Daniel Woodhead Co. Catalog Number 1203R-B163, Appleton Electric Co., or equal.

L. Lighting Contactor

1. Lighting contactors shall be of the electrically operated, mechanically held type in NEMA 1 enclosures of the number of poles as called for on the Drawings.

2. Contactors shall be rated for 20A-600 volt A.C. contacts and be similar and equal to Automatic Switch Co. bulletin 917 RC, Square D Co., Westinghouse Electric Corp., or equal.

M. Photo Electric Controls

1. Photo electric control with time delay for outdoor lighting shall be completely self-contained and not affected by moisture, vibration or temperature changes.

2. ON/OFF adjustments are to be made by movement of a light level selector without the use of tools in a range from 2 to 50 foot candles.

3. Photo electric control device shall be SPST, and have 2000 watt tungsten capacity and be Tork Catalog Number 2101 (120V); 2104 (208-277V) or equal by Intermatic Inc., Carlon, or equal.

4. Photo electric control for use in conjunction with electrically operated, mechanically held lighting contactors shall have a turn-lock photo control device. The complete assembly

shall be NEMA 3 rainproof construction with a SPDT, 1000 watt capacity relay and be Tork Catalog Number 5420 with a Model TMC-1 adapter for momentary contact operation or equal by Intermatic Inc., Carlon, or equal.

N. Emergency Lighting Battery Units

1. Emergency lighting units shall be fully automatic with (6-volt) (12-volt) lead acid batteries. Units shall be designed for (120) (277) volt, 60 Hertz input and have a sealed mercury relay, solid state charger, ready/off switch, press-to-test switch, amber "ready" light, volt meter and required number of supervisory relays.

2. Emergency lighting units shall be Emergency Lighting and Systems Inc. series, Chloride, Inc., Dual-Lite, or equal of capacities as indicated on the Drawings and be complete with all necessary mounting hardware.

3. Emergency lighting units shall each be equipped with a time delay relay to maintain emergency lighting in H.I.D. source lighted areas for 5 minutes after return of normal power.

4. Remote adjustable, wall mounting lighting heads shall each have 12 watt halogen lamps and be Emergency Lighting and Systems Inc. model RDQ or equal by Chloride, Inc., Dual-Lite, or equal.

5. Remote flush ceiling mounted lighting heads shall each have a 28 watt, 32 C.P. lamp and be Emergency Lighting and Systems Inc. model RNF or equal by Chloride, Inc., Dual-Lite, or equal.

6. Remote adjustable, wall mounting lighting heads for Class 1, Division 1, Group D hazardous areas shall each have a 25 watt sealed beam lamp and be Emergency Lighting and Systems Inc. model RXPS or equal by Chloride, Inc., Dual-Lite, or equal.

7. Remote adjustable, wall mounting, vaportight lighting heads each with 25 watt sealed beam lamps and be Emergency Lighting and Systems Inc. model RVT or equal by Chloride, Inc., Dual-Lite, or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Each fixture shall be a completely finished unit with all components, mounting and/or hanging devices necessary, for the proper installation of the particular fixture in its designated location and shall be completely wired ready for connection to the branch circuit wires at the outlet.

B. When fixtures are noted to be installed flush, they shall be complete with the proper accessories for installing in the particular ceiling involved. All flush mounted fixtures shall be supported from the structure and shall not be dependent on the hung ceilings for their support.

C. Flexible fixture hangers shall be used for all pendant mounted fixtures.

D. Conduit run in areas with hung ceilings shall be installed in the space above the hung ceiling as close to the structure as possible. Conduits shall be supported from the structure.

E. Switch and receptacle outlets shall be installed flush with the finished floor or wall when raceways are shown as "concealed" on the Drawings.

F. Receptacles in process areas and shops shall be mounted 36" above the floor unless otherwise noted on the Drawings.

G. Receptacles in office and other like areas shall be mounted 18 inches above the floor unless otherwise noted on the Drawings.

3.02 REPLACEMENT

A. Lamps (except for H.I.D.) used during the building construction, prior to two weeks from completion of the work, shall be removed and replaced with new lamps.

3.03 CLEANING UP

A. Plastic dust cover bags to be provided with new parabolic reflector lighting fixtures shall be removed after all construction activity that may cause dust formation on reflector surfaces has been completed.

B. All fixtures shall be left in a clean condition, free of dirt and defects, before acceptance by the Engineer.

END OF SECTION

SECTION 16600

UNDERGROUND SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install a complete underground system of raceways, manholes and handholes as shown on the Drawings and as specified herein. This work includes all underground raceways which are direct buried or concrete encased.

1.02 RELATED REQUIREMENTS

A. All concrete and reinforcing steel shall be as specified in Division 3, but the responsibility of furnishing and installing the material shall be that of this Section.

B. All trenching, excavation and backfilling, including gravel and sand bedding and surface restoration shall be as specified in Division 2, but the responsibility of furnishing and installing the material shall be that of this Section.

C. Conduit, fittings, installation, etc. shall be as specified in Section 16110.

D. Ground rods and other grounding materials and methods shall be as specified in Section 16660.

E. Precast electrical concrete manholes and handholes shall be furnished under Division 16.

1.03 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01300 for approval by the Owner, shop drawings and product data, for the following:

1. Manholes and handholes

2. Plastic duct spacers

3. Manhole and handhole frames and covers

PART 2 PRODUCTS

2.01 MATERIALS

A. Cable racks, supports, pulling-in irons, manhole steps and hardware shall be hot dipped galvanized steel as manufactured by Line Materials Co. or equal.

B. Precast concrete manholes and handholes shall be heavy duty type, designed for a Class H20 wheel load. Precast manholes and handholes shall be as manufactured by Brooks Products Co.

C. Manhole frames and covers shall be cast iron heavy duty type for class H-20 wheel loading, and shall be as manufactured by Neenah, or equal. Manhole covers shall be marked "ELECTRIC".

D. Handhole covers and frames shall be hot dipped galvanized and designed for a Class H-20 wheel load. Handhole covers and hatches shall have 316 stainless steel security bolts. Handhole covers shall be marked **"ELECTRIC"**.

E. Bell ends and plastic duct spacers shall be as manufactured by Carlon or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install raceways to drain away from buildings. Raceways between manholes or handholes shall drain toward the manholes or handholes. Raceway slopes shall not be less than 3-in per 100-ft.

B. Reinforce raceway banks as shown on the Drawings.

C. Lay raceway lines in trenches on a clean backfill bedding not less than 6 inches thick and well graded and compacted.

D. Make raceway entrances to buildings and vaults with hot dipped rigid galvanized steel conduit not less than 10-ft long. Conduits which are not concrete encased for runs below floor slabs in slab-on-grade construction shall be hot dipped rigid galvanized steel conduit. Conduits which are concrete encased for runs below floor slabs in slab-on-grade construction shall be encased under the slab to their respective equipment.

E. Raceway terminations at manholes shall be with end bells for PVC conduit and insulated throat grounding bushings with lay-in type lugs for metal conduit.

F. For bends in 2 inch and larger raceways, long radius elbows, sweeps and offsets shall be used.

G. All 2 inch and larger raceways shall have a mandrel drawn through followed by a swab to clean out any obstructions which may cause cable abrasions. The mandrel shall be 12 inches in length and the diameter 2 inch less than the inside diameter of the raceway. All 3/4 inch and smaller raceways shall be swabbed clean before installing cables.

H. Plug spare raceways and seal them watertight at all buildings and structures.

I. Raceways in use shall be sealed watertight at all buildings and structures.

J. Install pulling-in irons opposite all raceway entrances to manholes.

K. Cables shall be trained in manholes and supported on racks and hooks at intervals not greater than 3 feet-0 inches and supports shall be installed on each side of all splices. Furnish inserts on all manhole walls for mounting future racks as well as racks required for present installation. Branch circuit conductors shall not be run in manholes.

L. All joints shall be made so as to prevent the passage of concrete inside the conduit to form obstructions or cause cable abrasions.

M. Manhole covers in streets shall finish flush with finished paving and in other areas shall finish 3 inches above crown of adjacent roadway. Floor elevations of manholes shall be so set that the center line of the lowest conduit entering will be not less than 1-foot above the floor and center line of the highest conduit entering will be not less than 1 foot below the roof slab.

N. Concrete monuments shall be provided at each stubbed conduit location. Monuments shall be as shown on the Drawings and shall be installed in the same manner outlined for manhole covers.

O. A #6 bare copper wire (stranded) shall be installed in each 4-inch PVC conduit containing control cable unless otherwise noted.

P. A 3/4-inch by 10-foot copperclad ground rod shall be driven in the bottom of each manhole. All bond wires, galvanized conduits and metal cable racks shall be bonded to the ground rod.

Q. Polyethylene warning tape shall be provided for all underground raceways, duct banks etc. The detectable warning tape shall be placed along the raceways entire length and shall be installed 18" above the raceways on compacted backfill material.

R. All electrical duct banks shall be colored red for safety purposes.

S. Spare and empty conduits shall have a pull wire (3/16 inch polypropylene) installed.

T. As-built drawings shall be furnished showing each conduit terminations, elevations, locations, manholes, handholes, etc.

END OF SECTION

SECTION 16660

GROUNDING SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install a complete grounding system in strict accordance with Article 250 of the National Electrical Code (NEC), as shown on the Drawings and as specified herein.

B. All raceways, conduits and ducts shall contain equipment grounding conductors sized in accordance with the NEC. Minimum sizes shall be No. 12 AWG.

1.02 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01300 for approval by the Owner, shop drawings and product data, for the following:

1. Manufacturer's name and catalog data for ground rods, materials and exothermic welding methods and materials.

PART 2 PRODUCTS

2.01 MATERIALS

A. Conduit shall be as specified under Section 16110.

B. Wire shall be as specified under Section 16120.

C. Ground rods shall be 3/4-in diameter by 10-ft copper clad steel and constructed in accordance with UL 467. The minimum copper thickness shall be 0.25 mm. Ground rods shall be Copperweld or equal.

D. Grounding conduit hubs shall be malleable iron type, manufactured by Thomas & Betts Co.; Catalog No. 3940 (3/4-in conduit size), similar to Burndy; O.Z./Gedney Co. or equal, and of the correct size for the conduit.

E. Waterpipe ground clamps shall be cast bronze saddle type, manufactured by Thomas & Betts Co. Cat. No. 2 (1/2-in, 3/4-in, or 1-in size), similar by Burndy; O.Z./Gedney Co. or equal, and of the correct size for the pipe.

F. Buried grounding connections shall be by Cadweld process, or equal exothermic welding system.

PART 3 EXECUTION

3.01 INSTALLATION

A. The service entrance equipment ground bus shall be grounded to a 3/4-inch cold water pipe and to the ground as indicated on the Drawings. Run grounding electrode conductors in Schedule 80 PVC conduits and seal conduits watertight. Do not allow water pipe connections to be painted. If the connections are painted, disassemble them and re-make them with new fittings.

B. Install equipment grounding conductors with all feeders and branch circuits.

C. Bond all steel building columns in new structures together with ground wire in rigid conduit and connect to the distribution equipment ground bus, as shown on the Drawings.

D. Ground wire connections to structural steel columns shall be made by exothermic welding.

E. Metal conduits stubbed into a motor control center shall be terminated with insulated grounding bushings and connect to the motor control center ground bus. Bond boxes mounted below motor control centers to the motor control center ground bus. Size the grounding wire in accordance with NEC Table 250.122, except that a minimum No. 12 AWG shall be used.

F. Ground bus in all motor control centers and unit substations shall be connected to the service entrance equipment ground bus with a No. 1/0 conductor or as noted on the Drawings.

G. Ground transformer neutrals to the nearest available grounding electrode with a minimum conductor sized in accordance with NEC Article 250 or as shown on the drawings.

H. Drive grounding electrodes (where rock is encountered, grounding plates may be used in lieu of grounding rods) and install ground grids as shown on the Drawings.

I. All equipment enclosures, motor and transformer frames, conduits systems, cable armor, exposed structural steel and all other equipment and materials required by the NEC to be grounded, shall be grounded and bonded in accordance with the NEC.

J. Seal exposed connections between different metals with No-Oxide Paint Grade A or equal.

K. Lay all underground grounding conductors slack and, where exposed to mechanical injury, protect by pipes or other substantial guards. If guards are iron pipe, or other magnetic material, electrically connect conductors to both ends of the guard. Make connections as specified herein.

L. Care shall be taken to ensure good ground continuity, in particular between the conduit system and equipment frames and enclosures. Where necessary, jumper wires shall be installed.

M. All grounding type receptacles shall be grounded to the outlet boxes with a No. 12 THW green conductor connected to the ground terminal of the receptacle and fastened to the outlet box by means of a grounding screw.

3.02 INSPECTION AND TESTING

A. Inspect the grounding and bonding system conductors and connections for tightness and proper installation.

B. Use Biddle Direct Reading Earth Resistance Tester or equivalent test instrument to measure resistance to ground of the system. Perform testing in accordance with test instrument manufacturer's recommendations using the fall-of-potential method. Notify the Engineer in writing at least two weeks prior to scheduling any testing. Provide certified calibration sheets including dates for all equipment to be used for testing with notice of scheduled testing. Calibration sheets shall also indicate that the units have been calibrated within six months of the testing date.

C. All test equipment shall be provided under this Section and approved by the Engineer.

D. Resistance to ground testing shall be performed during dry season. Submit test results in the form of a graph showing the number of points measured (12 minimum) and the numerical resistance to ground.

E. Testing shall be performed before energizing the distribution system.

F. A separate test shall be conducted for each building or system.

G. Dry season resistance of the system at each testing location shall not exceed five ohms. If such resistance cannot be obtained with the system, provide additional grounding, as directed by the Engineer, at no additional cost to the Owner.

END OF SECTION

SECTION 16900

CONCRETE ELECTRICAL DUCT ENCASEMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and place concrete encasement around underground electrical ductwork as shown on the drawings and as specified herein.

1.02 RELATED REQUIREMENTS

A. All concrete and reinforcing steel shall be as specified in Division 3, but the responsibility of furnishing and installing the material shall be that of this Section.

B. All trenching, excavation and backfilling, including gravel and sand bedding and surface restoration shall be as specified in Division 2, but the responsibility of furnishing and installing the material shall be that of this Section.

C. Furnishing and installing electrical raceways are specified in Section 16110 and 16600.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cement, lime, aggregate and all other concrete components shall be as specified in Section 03300 except that aggregate size shall not exceed 3/8-in. Concrete shall be Class A concrete as specified in Section 03300.

PART 3 EXECUTION

3.01 GENERAL

A. Concrete shall be measured, mixed and placed, and compacted as required in Section 03300 for Class A concrete and as specified below. Aggregate size shall not exceed 3/8".

B. Specified concrete compressive strength needs to be coordinated with the mixes specified in Section 03300.

C. Provide not less than 3-inches of concrete between the outside of a duct and the earth. Provide not less than 2-inches of concrete between adjacent ducts. Refer to drawings for spacing requirements.

D. All duct line concrete pours shall be continuous between manholes or handholes and between manholes or handholes and structures.

E. Where duct lines pass through concrete walls, concrete envelopes shall be extended through the finished flush with inside surfaces. Watertight construction joints of an approved type shall be provided.

F. Duct banks shall be reinforced when laid on backfill covering new pipelines, roads, parking lots or any are subject to vehicular traffic. Beneath these areas, install reinforcing bars as shown on the Drawings, extending 10-ft beyond area needing protection.

G. Duct lines shall be laid in trenches on mats of gravel not less than 6-inches thick and well graded.

H. The minimum cover for duct banks shall be 30-inches.

I. All electrical duct bank concrete shall be colored red.

END OF SECTION