BIDDING/CONTRACT DOCUMENTS

For The
“Happy Jack Landfill Phase 2, Cells 1 and 2 Construction and Cell 3 Excavation Earthworks” Project

Bid No. S-6-21

BID OPENING: Thursday, October 1, 2020 at 2:00 p.m.

In the
City Purchasing Office
Room 307, Municipal Building
2101 O'Neil Avenue
Cheyenne, WY 82001

Inquiries Regarding This Bid Should Be Directed To:

City of Cheyenne, Purchasing Manager, TJ Barttelbort
Phone: (307) 773-1045, Email: tbarttelbort@cheyennecity.org
# INVITATION FOR BID

## #S-6-21

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PART 1 – INVITATION FOR BIDS
CITY OF CHEYENNE, WYOMING

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NAME OF JOB: Happy Jack Landfill Phase 2, Cells 1 and 2 Construction and Cell 3 Excavation Earthworks

BID NUMBER: S-6-21

The Governing Body of the City of Cheyenne, Wyoming (“the Governing Body”) will receive sealed bid proposals at the Office of the City Purchasing Agent, located in Room 309 of the Municipal Building at 2101 O’Neil Avenue, Cheyenne, WY 82001, until 2:00 p.m. local time on the 1st day of October, 2020, for the “Happy Jack Landfill Phase 2, Cells 1 and 2 Construction and Cell 3 Excavation Earthworks” project.

At the aforementioned time and place, such bids that are received for the project shall be publicly opened and read aloud.

The work to be performed will be in accordance with the plans and specifications on file in the City Purchasing Agent’s office. Bidding documents may be downloaded online at https://www.cheyennecity.org/Bids.aspx.

A pre-bid meeting will be held at 11:00 A.M. on September 9, 2020, at the City of Cheyenne Municipal Building, Room 208, Cheyenne, WY 82001. Please see Part 2, 25.00 PRE-BID CONFERENCE for additional clarification and information. Any interested parties wishing to attend the pre-bid meeting are asked to wear a face-mask or face-covering.

A bid guarantee in the amount of five percent (5%) of the total bid shall accompany any bid submitted. See Section 8.00 of Instructions to Bidders. The successful bidder shall furnish and pay for satisfactory performance and payment bonds in the amount of one hundred percent (100%) of the accepted bid. See Section 19.00 of Instructions to Bidders.

The City of Cheyenne (“the City”) reserves the right to reject any or all bids or to waive any formalities in the bidding.

Prior to the award of the contract, the City may hold bids for a period not to exceed sixty (60) calendar days from the date of opening of bids for the purpose of reviewing the bids and investigating the qualifications of the bidders. Provisions of Wyo. Stat. § 15-1-113, incorporated by reference, are made an express part of the Contract Documents.

TJ Barttelbort
Purchasing Division

Publication Dates: September 4 & 11, 2020
Published in: Wyoming Tribune Eagle
PART 2 - INSTRUCTIONS TO BIDDERS
CITY OF CHEYENNE, WYOMING

1.00 USE OF SEPARATE BID FORMS

These Contract Documents include a complete set of bidding and contract forms which are for the convenience of bidders. Bidders shall make proposals upon the forms furnished herein and pursuant to the instructions and requirements set forth herein.

2.00 INTERPRETATION OF DOCUMENTS

The City will not provide oral interpretations to any bidder as to the meaning of the Contract Documents or any part thereof. If any person contemplating submitting a proposal requires interpretation or clarification regarding the meaning of any part of the drawings, specifications, or other portions of the contract documents, or finds discrepancies in or omissions from the drawings or specifications, that bidder shall submit a written request for interpretation, clarification, or correction thereof to the City of Cheyenne, hereinafter “City”. The bidder submitting the request will be responsible for its prompt delivery. Questions shall be directed to the City Purchasing Manager, by e-mail at tbarttelbort@cheyennecity.org. Questions will be received until 5:00 pm local time on September 15, 2020, after which no additional questions will be accepted. The City will respond via Addendum, no-later-than 5:00 pm local time on September 21, 2020.

3.00 ADDENDA

The City will make every interpretation, clarification, or correction to bidders by written addendum to the Contract Documents. The City will make reasonable efforts to mail, e-mail, or fax addenda to persons identified on the City’s plan-holders list, but it shall be the bidder’s responsibility to make inquiry as to the addenda issued. It shall also be the bidder’s responsibility to confirm that it is included on the City’s plan-holders list. The bidder shall acknowledge all addenda issued during the time of bidding in the bid proposal and shall be made a part of the Contract. The City will consider as incomplete any bid proposal in which all addenda are not acknowledged.

4.00 DEFINITIONS AND TERMS

Contract Documents: All documents in the bidding packet, including addenda, as identified in Part V, Article 5.

Contract Modification: A written document that must, at minimum, be executed by the Contractor and by the Mayor of the City of Cheyenne. A Contract Modification may require the approval of the City’s Governing Body. A contract modification must be executed to change the Contract Price, Contract Time, or to otherwise modify the Contract Agreement.

Contract Price: The original amount bid by the contractor, as specified in Article 4 of the Agreement and modified by any Contract Modifications.
Contract Time: Begins upon the date specified in the Notice to Proceed and consists of the number of calendar days up to and including the date specified in Part V, Article 3.

Field Order: A form issued by the City Engineer (“Engineer”) to authorize the Contractor to proceed with changes or additions to the work as described in a Work Directive or a Request for Adjustment. A Field Order may either increase or decrease quantities or authorize work for payment under a Force Account, if included in the bid, but cannot increase the Contract Price.

Force Account: A method of payment for work performed by the Contractor at the Engineer’s discretion and calculated in accordance with Part VI, Section 14.

Request for Adjustment: A form issued by the Engineer to allow the Contractor to request an adjustment of the Contract Time, the Contract Price, or to request any other modification of the Contract Agreement. The Contractor shall also use this form for submitting pricing as a result of a Work Directive.

Work Directive: A form issued by the Engineer to inform the Contractor of a change in the Work which does not alter the Contract Time, the Contract Price, or any other provisions of the Contract Agreement. If a change in the Work will increase the Contract Price, the City must approve and execute a Contract Modification before the Contractor may proceed with the Work as modified.

5.00 SITE INSPECTION AND CONTRACT DOCUMENTS EXAMINATION

Each bidder shall visit the proposed work site and become acquainted with the existing conditions of the site. Then, in preparing and submitting bids, contractors should take into account the observed existing conditions, construction necessities, required labor, facilities involved, and difficulties and restrictions that may be encountered in contract performance. If possible, the City will conduct a tour of the work areas. All interested parties should contact Matt Theriault in the City’s Public Works Office, at 307-637-6279.

Each bidder should also thoroughly examine and become familiar with the Drawings, Technical Specifications, and all other Contract Documents.

The selected bidder, by executing a contract, shall in no way be relieved of any obligation under it due to the selected bidder’s failure to review or examine any form, legal instrument, or to become acquainted with existing conditions in the work area. The City will be justified in rejecting any claim based on facts which the selected bidder knew or should have been aware of as a result of inspecting the site and Contract Documents.

6.00 ALTERNATE BIDS

The City will not consider alternate bids unless alternate bid items are specifically requested by the Specifications and the bid proposal.
7.00 BID PROPOSAL REQUIREMENTS

Bidders shall submit all bids on forms supplied by the City, and all such bids are subject to the Contract Documents requirements. All bids shall be regular in every respect. The bidder shall not make or include any interlineation, excisions, or special conditions in the bid forms. The bidder shall explain or note, in conjunction with its signature, any erasures or other changes in the bids.

The bidder shall submit bid documents, including the Bid Proposal, Bid Guarantee, Non-Collusion Affidavit of Prime Bidders, and Sub-Contractors and Material Suppliers List, to the City Purchasing Division in a sealed envelope. The envelope shall bear the bidder’s name and address, the project name, bid number, and the date and time of bid opening in order to guard against premature opening of the bid proposal.

The City may consider as irregular any bid on which there is an alteration of or departure from the bid form provided and, at its option, may reject the bid.

Award of a contract resulting from this bid will be based on Section 15.00 below.

The bidder shall correctly fill in the blank spaces on the proposal form and state the unit or lump sum prices in the spaces provided. All proposals shall be totaled, and in the case of errors or discrepancies, the unit or lump sum prices shall govern.

Each bidder shall sign and display the name and address of the bidder in the blank spaces provided. If the bid is made by a sole proprietorship or partnership, the name and address of the sole proprietorship or partnership shall be shown, together with the names and addresses of the proprietor or partners. If the proposal is made by a corporation or other business entity, an official who is authorized to bind the corporation or other business entity shall sign in the name of such corporation or business entity.

The City will consider as incomplete and may reject any bid not displaying the information required by this Section.

City representatives and the successful bidder shall hold a pre-construction conference upon contract award. This conference will be for the purpose of reaching a complete understanding with the successful bidder concerning quality of work expected, work schedule and time of completion, work progress, and coordination of all construction.

8.00 BID GUARANTEE

Each bid proposal shall be accompanied by a bid guarantee which shall not be less than five percent (5%) of the bid amount.

The 5% bid guarantee may be in the form a bid bond secured and issued by a surety or guaranty company authorized to do business in the State of Wyoming or a cashier’s check made payable to the City of Cheyenne. Cash deposits, personal checks or company checks (unless certified) will not be accepted.
If the bid guarantee is to be submitted in the form of a bid bond, bidders must use the attached bid bond form. No deviation from the attached form will be allowed. If a surety company’s bid bond form is used, the wording shall be exactly as shown on the City’s bid bond form. No bid will be considered unless it is accompanied by the required guarantee. The bid guarantee shall ensure the execution of the agreement. The successful bidder shall furnish a surety bond as required by the Contract Documents.

If the Contractor (i) withdraws the bid within sixty (60) calendar days after bid opening, (ii) fails to provide performance and payment bonds, (iii) or fails to provide the minimum insurance certificates within the time required by Wyo. Stat. § 15-1-113 after the City accepts the proposal, then the bidder shall be liable to the City for default in the amount set forth on the bid bond as liquidated damages for said default.

Bid guarantees of unsuccessful bidders will be returned as soon as practicable after bid proposals are opened.

9.00 **COLLUSIVE AGREEMENTS**

Each bidder submitting a bid to the City for any portion of the work contemplated by the documents on which bidding is based shall execute and attach thereto an affidavit substantially in the form herein provided to the effect that he or she has not colluded with any other person, firm, or corporation in regard to any bid submitted.

10.00 **STATEMENT OF BIDDER QUALIFICATIONS**

Each bidder shall, upon the City’s request, submit satisfactory evidence that the bidder has practical knowledge of the particular work being bid upon, and has the necessary financial resources required to complete the proposed work. In awarding the contract, the City will give due consideration to the ability, reliability, work load, and general reputation of each bidder, as well as the City’s past experience with the bidders.

Each bidder, upon the City’s request, shall show that prior work performed by the bidder has been handled in such a manner that there are no just or proper claims against such work.

No bid proposal will be acceptable if the bidder is engaged in any other work which impairs his or her ability to finance this contract or provide equipment for the proper execution of the contract.

11.00 **UNIT PRICES**

If unit prices are called for, the unit price of each item in the proposal shall include the pro rata share of overhead and profit. As such, the sum of the products obtained by multiplying the quantity shown for each item by the unit price bid equals the total bid. The City may reject as irregular any bid not conforming to this requirement. Bidders should pay special attention to this provision.

If conditions make it necessary to revise bid quantities, no limit will be fixed for such quantity revisions, provided the net cash value of all such additive and subtractive changes shall not change the original, total contract price by more than twenty percent (20%). The
quantities appearing on the proposal form are approximate and are prepared for the comparison of bids. Payment to the contractor will be made only for the actual, accepted quantities of work performed and materials furnished in accordance with the contract.

The presence of any unit bid price that generates reasonable doubt that award to that bidder would result in the lowest ultimate cost to the City may be rejected as irregular.

12.00 TIME FOR RECEIVING BIDS

Bid proposals received before the advertised time for opening bids will be kept securely sealed until the time arrives to open bids. The officer whose duty it is to open bids will decide when the specified time has arrived, and no bid received thereafter will be considered.

13.00 BID OPENING

At the time and place fixed for opening bids, the City will open and publicly read aloud every bid received within the time set for receiving bids, irrespective of any irregularities therein. Bidders and other persons properly interested may be present in person or by representative.

14.00 BID WITHDRAWAL

Bids may be withdrawn by written or faxed request at any time prior to the scheduled closing time for receipt of proposals.

15.00 CONTRACT AWARD AND BID REJECTION

The City will award the contract to the most qualified and responsible bidder, as determined in the City’s sole discretion, who submits the lowest total responsive bid shown on Itemized Bid Sheet “A” plus “B”. This bid must also be less than funds available for this project. The City reserves the right to reject a bid if the total bid shown on the last Itemized Bid Sheet is not identical to the total bid shown on the Bid Proposal Sheet, included in this Bid Packet. The City reserves the right to reject a bid if the total bid price shown on the last Itemized Bid Sheet is not calculated correctly.

The City reserves the right to reject any or all proposals or to waive any formality or irregularity in any proposal in the interest of the City. No bidder may withdraw his proposal for a period of sixty (60) calendar days after the date of opening thereof.

16.00 FUNDS PROGRAMMED

The funds programmed for construction are estimated to be sufficient to provide for the proposed work shown on the plans. In the event contract unit prices indicate a total cost of the project in excess of the allotted funds, the project length may be shortened or quantities decreased to keep the cost of work within the funds allocated to the project. Similarly, if the contract unit prices indicate a total cost of the project less than the allotted funds, the length of the project may be increased and quantities added to ensure the allotted funds for the project are used.
PREFERENCE FOR STATE LABOR AND MATERIALS

Pursuant to Wyo. Stat. § 16-6-104, Wyoming made materials and products, and Wyoming suppliers of products and materials of equal quality and desirability shall have preference over materials or products produced or supplied outside the state and any contract let shall so provide. The City shall apply the preference created by Wyo. Stat. § 16-6-104 in a manner identical to the preference for resident contractors in Wyo. Stat. § 16-6-102.

Pursuant to Wyo. Stat. § 16-6-102, the City shall award the contract to the responsible, certified resident making the lowest responsible bid, if the certified resident’s bid is not more than five percent (5%) higher than the lowest responsible, nonresident bidder.

Pursuant to Wyo. Stat. § 16-6-103, a successful resident bidder shall not subcontract more than thirty percent (30%) of the work covered by the contract to nonresident contractors.

Pursuant to Wyo. Stat. § 16-6-106, preference is hereby given to materials, supplies, agricultural products, equipment, machinery, and provisions produced, manufactured, or grown in Wyoming, or supplied by a state resident, quality being equal to articles offered by the competitors outside of the state.

Pursuant to W.S.§ 16-6-107, the structure or structures to be constructed pursuant to this invitation to bidders shall be constructed and maintained by materials produced or manufactured in Wyoming if Wyoming materials are suitable and can be furnished in marketable quantities. Preference shall not be granted for materials of an inferior quality to those offered by competitors outside of the state, but a differential of five percent (5%) shall be allowed in cost of contracts Wyoming materials produced or manufactured in Wyoming.

Pursuant to Wyo. Stat. § 16-6-203, the successful bidder shall employ only Wyoming laborers on the project, and the contract awarded to the successful bidder shall contain a provision requiring that Wyoming labor be used, except other laborers may be used when Wyoming laborers are not available for employment within the state, or are not qualified to perform the work involved. In addition, the contract shall contain a provision requiring specific acknowledgement of the requirements of this section. The successful bidder may employ laborers other than Wyoming laborers if:

(i) The successful bidder informs the nearest state workforce center of his employment needs at least eleven (11) calendar days before work is commenced;

(ii) The state workforce center certifies that the bidder’s need for laborers cannot be filled from those Wyoming laborers listed with the Wyoming Department of Workforce Services. The department shall respond to a bidder’s request for certification within ten (10) calendar days of the date the information is filed; and
The successful bidder shall also agree to promptly respond to requests from the Wyoming Department of Workforce Services for the most recent construction schedule for the project.

18.00 **CERTIFICATE OF RESIDENCY STATUS FOR IN-STATE PREFERENCE**

Wyoming Contractors desiring residency status for the purpose of obtaining the five percent (5%) preference for resident bidders on public works projects must be so certified by the Wyoming Department of Workforce Services. No bidder may be considered a resident for the purpose of the five percent (5%) preference unless his residency has been certified as provided in Wyo. Stat. § 16-6-101.

19.00 **AGREEMENT EXECUTION, PERFORMANCE, AND PAYMENT BONDS**

Subsequent to the award and within fifteen (15) calendar days after the prescribed forms are presented for signature, the successful bidder shall execute and deliver to the City an agreement in the form included in the Contract Documents in such number of copies as the City may require and at the same time shall also provide the insurance, Workers Compensation and Unemployment insurance certificates, and the performance and payment bonds. The performance and payment bonds will remain active for the two (2) year warranty period, which is the two (2) year period following the City’s acceptance of the substantial completion certificate. If the Contractor is required to perform corrections in the work of the project in the two (2) year warranty period, the Contractor shall provide copies of their current insurance, Worker’s Compensation, and Unemployment Insurance Certificates as required in the original project.

Having satisfied all conditions of award as set forth elsewhere in these documents, the successful bidder shall, within the period specified in paragraph “a.” above, furnish a surety bond, not less than the amount of the contract as awarded, as security for the faithful performance of the contract and a bond in an equal sum as surety for the payment of all persons, firms, or corporations to whom the successful bidder may become legally indebted for labor, materials, tools, equipment, or services of any nature, including utilities and transportation services employed or used by him in performing the work. Such bond or bonds shall be in the same form as that included in the Contract Documents and shall bear the same date as that of the agreement. The current power of attorney for the person who signs for any surety company shall be attached to such bonds. These bonds shall be signed by an authorized agent of the surety company qualified to do business in the State of Wyoming. The successful bidder shall notify the surety of any changes affecting the general scope of the project or change in the Contract Price, and the amount of the bonds shall be adjusted accordingly. The successful bidder shall furnish proof of such adjustment to the City.

The successful bidder’s failure to execute such agreement, or to supply the required bond or bonds within thirty (30) calendar days after the prescribed forms are presented for signature, or within such extended period as the City may grant based upon reasons determined sufficient by the City, shall constitute a default. The City may then award the contract to the next lowest, responsible bidder or re-advertise for bids, and the bid guarantee of the bidder shall be forfeited to the City as liquidated damages as per Wyo. Stat. § 15-1-113(f). The City may also charge against the defaulting bidder the additional
difference between the amount of the original low bid and the amount for which the contract is subsequently let, if the amount exceeds the amount of the bid bond. If a more favorable bid is received by re-advertising, the defaulting bidder shall have no claim against the City for a refund.

If the cost of a payment and performance bond is included in the bid, the successful bidder may receive reimbursement for the costs of the bonds subject to the following requirements. If the bond cost is not included as a bid item, the bond cost shall be deemed to have been included in the Contract Price.

Subsequent to the contract award and compliance with the conditions stated in the preceding paragraph, the successful bidder may submit a written request to the engineer in charge of the project requesting the payment and performance bid item. The successful bidder shall include with this written request, a statement from the insuring firm, indicating the bond cost based on the preliminary estimate of the cost of the contract or as adjusted by the final contract price. Payment for the bond cost will be computed on the basis of the final Contract Price or on the basis of the preliminary cost estimate of the contract, whichever is less. The payment for a payment and performance bond may be adjusted upon project completion based on approved modifications to the Contract Price.

20.00 **SALES AND USE TAX PROVISIONS**

The successful bidder shall abide by Wyo. Stat. § 39-15-101 *et seq.*, and Wyo. Stat. § 39-16-101 *et seq.*, relating to Sales and Use Taxes. In particular, the successful bidder shall abide by the guidance provided in State of Wyoming, Department of Revenue Bulletin, “Use Tax and You” issued December 5, 2012, revised July 1, 2014. This Bulletin is available on-line through the Wyoming Department of Revenue’s website. If the Contractor has difficulty locating the Bulletin, they may contact the Wyoming Department of Revenue for assistance.

The successful bidder shall cause all subcontractors to abide by and perform their work on the same terms and conditions as provided above. The successful bidder shall cause the above statements to be inserted in any contract or agreement between the successful bidder and subcontractors.

The successful bidder shall notify the Wyoming Department of Revenue, Excise Tax Division, when they begin work on any project in the State of Wyoming. The notice shall include the project name, specific project location and contract amount. Questions regarding sales and use taxes should be directed to the Wyoming Department of Revenue, Excise Tax Division at (307) 777-5204.

21.00 **TRADE NAME PROVISIONS**

When in the specifications or drawings, an item is identified by a manufacturer’s name, trade name, catalog number, or reference, the bidder proposes to furnish the item so identified and does not propose to furnish an “equal” unless the proposed “equal” is clearly communicated to the City by the bidder, and the bidder has obtained prior certification from the City for approval of the proposed “equal”.

The successful bidder shall notify the Wyoming Department of Revenue, Excise Tax Division, when they begin work on any project in the State of Wyoming. The notice shall include the project name, specific project location and contract amount. Questions regarding sales and use taxes should be directed to the Wyoming Department of Revenue, Excise Tax Division at (307) 777-5204.
The reference to a manufacturer’s name, trade name, or catalog number is intended to be descriptive, but not restrictive, and only to indicate to the bidder articles that will be satisfactory. Bids on other makes, catalog numbers, etc., will be considered, provided each bidder clearly states on the bid proposal exactly what the bidder proposes to furnish, and has submitted to the City, at least seven (7) calendar days prior to the bid opening date, illustrations, specifications, or other descriptive matter which clearly indicate the character of the article(s) to be covered by the bid, and has obtained the prior approval of the City for the proposed “equal”.

The City reserves the right to approve as an equal, or to reject as not being equal, any article the bidder proposes to furnish which contains major or minor variations from specifications but which may comply substantially therewith.

22.00 RETAINAGE ADMINISTRATION FOR CONTRACTS EXCEEDING $50,000.00

The City will withhold five percent (5%) of the work’s dollar value completed throughout the contract term.

If requested by the general contractor, the City shall enter into an interest bearing deposit agreement with any depository designated by the general contractor, after notice to the surety, to provide an agent for the custodial care and servicing of any deposits placed with it pursuant to this act on any contract of more than fifty thousand dollars ($50,000.00) pursuant to Wyo. Stat. § 16-6-704. Interest income will be paid to the successful bidder as collected or as otherwise instructed by the successful bidder. All expenses incurred for this service will be charged to the successful bidder and deducted from payments due and retained funds.

If the City finds that satisfactory progress is being made in all phases of the contract it may, upon written request by the contractor, authorize payment from the withheld percentage. Before the payment is made, the public entity shall determine that satisfactory and substantial reasons exist for the payment and shall require written approval from any surety furnishing bonds for the contract work in accordance with Wyo. Stat. § 16-6-116.

No payments returning retainage from this fund will be made until the City has determined that satisfactory and substantial reasons exist for the payment, and the required Certificate of Completion; Affidavit of Release of Liens; Contractor’s Final Waiver of Liens; Sub-Contractor’s Final Waiver of Liens; Consent of Surety for final payment; Sworn Statement for Final Payment Pursuant to Wyo. Stat. § 16-6-116 and § 16-6-117; and Engineer’s Certificate of Completion have all been received by the City, and all the items on the punch list have been completed.

23.00 SUB-CONTRACTORS, MATERIALMEN PROTECTION UNDER A BOND OR GUARANTEE; LIMITATIONS.

For contracts of $150,000.00 or more, the Contractor shall post on the construction site a prominent sign citing Wyo. Stat. § 16-6-121 and stating that any Sub-Contractor or materialmen shall give notice to the Contractor of a right to protection under the bond or guarantee and that failure to provide the notice shall waive the Sub-Contractor or materialmen’s protection under the bond or guarantee and shall waive any right to a lien.
for material or services provided. The general contractor shall post on the construction site a prominent sign citing this section and stating that any subcontractor or materialman shall give notice to the general contractor of a right to protection under the bond or guarantee and that failure to provide the notice shall waive the subcontractor or materialman's protection under the bond or guarantee.

24.00 PERMITS AND LICENSES

The Contractor shall obtain all permits necessary to execute the work. Fees will be waived for permits issued by the City. Permits may be required by other entities which are not furnished or paid for by the City. The successful bidder and its subcontractors shall be required to hold and pay for any licenses required and shall also pay for all public utility charges.

25.00 PRE-BID CONFERENCE

A pre-bid meeting will be held at 11:00 A.M. on September 9, 2020, at the City of Cheyenne Municipal Building, Room 208, Cheyenne, WY 82001.

The Pre-Bid meeting shall be MANDATORY for any bidder submitting a bid for the Earthworks Project. The City will reject bids from any company who has not signed the attendance sheet prior to the commencement of the mandatory pre-bid meeting. Any bidder attending the pre-bid meeting shall wear a face mask or face covering while present in the City of Cheyenne Municipal Building, or while present in any meeting room.

The Pre-Bid meeting shall be OPTIONAL for any bidder submitting a bid for the Geosynthetics Installation or Geosynthetics Procurement. Any parties wishing to join the Pre-Bid meeting remotely (That won’t be submitting a bid for the Earthworks portion of the project), may utilize the following Phone # and Pin to join via Conference Call.

Conference Call-In Information:

Dial In Info: (307) 773-1027
Participant Code: 388-347-01

Any interested bidder may still attend the in-person meeting, even if they are not submitting on the Earthworks Project.
**CITY OF CHEYENNE BID PROPOSAL FORM**

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<th>BID NO.</th>
<th>S-6-21</th>
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<td>OPEN DATE:</td>
<td>Thursday, October 1, 2020</td>
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<tr>
<td>TIME:</td>
<td>2:00 PM</td>
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<td>PROJECT:</td>
<td>Happy Jack Landfill Phase 2, Cells 1 and 2 Construction and Cell 3 Excavation Earthworks</td>
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**TO:** GOVERNING BODY  
CITY OF CHEYENNE  
2101 O’NEIL AVENUE  
CHEYENNE, WY 82001  
(Submit bids to the City Purchasing Division, Room 309, Municipal Bldg. at 2101 O’Neil Avenue)

1. Pursuant to and in full compliance with all Bidding Documents, the undersigned Bidder hereby proposes to furnish all the labor and materials and to perform all the work required for the complete and prompt execution of everything described or shown in or reasonably implied by the Bidding Documents, including the Drawings and Specifications, for the work above indicated for the monies stated herein, which includes all State, County and local taxes normally payable in respect to such work when done for an entity not entitled to any exemption from such taxes. The amounts stated include all allowances for profit and overhead, taxes, fees and permits, transportation, services, tools and equipment, labor and materials and other incidental costs.

2. The Bidder has carefully examined the Bidding Documents, including the Drawings and Specifications and the work site, and has fully apprised him/her-self of the conditions affecting the work to be executed, and hereby proposes to construct and complete the above-referenced project, all in accordance with the Bidding Documents, at and for the following sum, as reflected in the total on the attached itemized bid sheets:  

*Please write “Not Bidding” on any Bid Schedule you are not submitting*

**EARTHWORKS PROJECT (TOTAL BASE BID)**

_______________________________ Dollars

($_______________________________).

**GEOSYNTHETICS INSTALLATION (TOTAL BASE BID)**

_______________________________ Dollars

($_______________________________).

**GEOSYNTHETICS PROCUREMENT (TOTAL BASE BID)**

_______________________________ Dollars

($_______________________________).
3. This Bid Proposal is accompanied by the required Bid Guarantee of five percent (5%) based upon the total cost of all items required to be bid. The City of Cheyenne is authorized to hold said Bid Guarantee for a period of not more than sixty (60) calendar days after the opening of the bids for the purpose of evaluating bids prior to award. If awarded the contract for this work, the undersigned Bidder agrees to execute the Agreement and furnish the required Bonds and Insurance Certificates within thirty (30) calendar days from the date of Notice of Award.

4. Attached hereto is an affidavit in proof that the undersigned has not entered into a collusive agreement with any person in respect to this bid or any other bid or the submitting of bids for which this bid is submitted.

5. The undersigned bidder has [ ] has not [ ] been granted a State of Wyoming Certificate of Residency Status. If the bidder has been granted a State of Wyoming Certificate of Residency Status, the undersigned bidder has [ ] has not [ ] subcontracted more than thirty percent (30%) of the work covered by this contract to nonresident bidders, as per Wyo. Stat. § 16-6-103 regarding limitations on subcontracting by resident contractors.
Dated this __________ day of _________________, __________

(Month) (Year)

FIRM NAME:__________________________________________

Bidder’s Legal Stature:
☐ Corporation
☐ Partnership
☐ Individual Sole Proprietorship
☐ L.L.C.
☐ Other:_____________________

State of Incorporation:__________________________________

Bidder’s Address:________________________________________

_____________________________________________________

_____________________________________________________

Telephone Number:______________________________________

Email Address: _________________________________________

By:___________________________________________________

(Bidder’s Signature)

Title:__________________________________________________

_____________________________________________________

Witness

The Bidder acknowledges receipt of the following addenda to the Bid Documents (if none, so state):__________________________________________________________.

Addendum No. Dated

________________________________________________________________

________________________________________________________________

________________________________________________________________
## BASE BID UNIT PRICE SCHEDULE

<table>
<thead>
<tr>
<th>Bid Item</th>
<th>Bid Item Description</th>
<th>Unit</th>
<th>Bid Quantity</th>
<th>Unit Price</th>
<th>Total Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mobilization/Demobilization</td>
<td>LS</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Erosion and Sediment Control</td>
<td>LS</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Strip and Stockpile Topsoil</td>
<td>CY</td>
<td>30,400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Excavation</td>
<td>CY</td>
<td>2,200,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Prepare Cell Subgrade (Finish Grading)</td>
<td>SY</td>
<td>58,500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Anchor Trench</td>
<td>LF</td>
<td>2,200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Sand Drainage Layer</td>
<td>CY</td>
<td>17,500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Cell 2 Termination Berm</td>
<td>LF</td>
<td>490</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Perimeter Road and Stormwater Channels</td>
<td>LF</td>
<td>3,300</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>WYDOT Class W Road Base</td>
<td>CY</td>
<td>2,700</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Sump Construction</td>
<td>EA</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>LCRS Collection Pipe</td>
<td>LF</td>
<td>870</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Leachate Collection Pump</td>
<td>EA</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Sump Sideslope Riser Pipes</td>
<td>LF</td>
<td>365</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Concrete Pipe Protection Slab</td>
<td>CY</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>LCRS Discharge Pipe Systems</td>
<td>EA</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Pressurized Leachate Force Main</td>
<td>LF</td>
<td>2,415</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Seeding</td>
<td>ac</td>
<td>63</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Chain Link Fence</td>
<td>LF</td>
<td>2,210</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL BASE BID:** $

## BID ALTERNATE UNIT PRICE SCHEDULE

<table>
<thead>
<tr>
<th>Bid Item</th>
<th>Bid Alternate Description</th>
<th>Unit</th>
<th>Bid Alternate Quantity</th>
<th>Unit Price</th>
<th>Total Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>7A</td>
<td>Operations Layer</td>
<td>CY</td>
<td>17,500</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## BASE BID UNIT PRICE SCHEDULE

<table>
<thead>
<tr>
<th>Bid Item</th>
<th>Bid Item Description</th>
<th>Unit</th>
<th>Bid Quantity</th>
<th>Unit Price</th>
<th>Total Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mobilization/Demobilization</td>
<td>LS</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Installation of GCL</td>
<td>SF</td>
<td>536,500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Installation of 60 mil HDPE Geomembrane</td>
<td>SF</td>
<td>536,500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Installation of Pipe Penetration</td>
<td>LS</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL BASE BID:** $ 

## BID ALTERNATE UNIT PRICE SCHEDULE

<table>
<thead>
<tr>
<th>Bid Item</th>
<th>Bid Alternate Description</th>
<th>Unit</th>
<th>Bid Alternate Quantity</th>
<th>Unit Price</th>
<th>Total Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Installation of Geocomposite</td>
<td>SY</td>
<td>536,500</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### BASE BID UNIT PRICE SCHEDULE

<table>
<thead>
<tr>
<th>Bid Item</th>
<th>Bid Item Description</th>
<th>Unit</th>
<th>Bid Quantity</th>
<th>Unit Price</th>
<th>Total Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Furnish 60 mil HDPE Geomembrane (double-sided textured)</td>
<td>SF</td>
<td>591,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Furnish Geosynthetic Clay Liner (GCL)</td>
<td>SF</td>
<td>591,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Furnish 12 oz/sy Nonwoven Geotextile Fabric</td>
<td>SF</td>
<td>17,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Furnish 16 oz/sy Nonwoven Geotextile Fabric</td>
<td>SF</td>
<td>27,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL BASE BID:** $

---

### BID ALTERNATE UNIT PRICE SCHEDULE

<table>
<thead>
<tr>
<th>Bid Item</th>
<th>Bid Alternate Description</th>
<th>Unit</th>
<th>Bid Alternate Quantity</th>
<th>Unit Price</th>
<th>Total Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Furnish 200 mil Geocomposite</td>
<td>SY</td>
<td>591,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CITY OF CHEYENNE NON-COLLUSION
AFFIDAVIT OF PRIME BIDDERS FORM

State of: ________________________________
County of: ________________________________

______________________________________, being first duly sworn, deposes and says that:

(1) S/he is (owner, partner, officer, representative, or agent) of ____________________________________________, the bidder that has submitted the attached bid;

(2) S/he 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, has 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 contract of which the attached bid has been submitted or to refrain from bidding in connection with such contract, or has in any manner, directly or indirectly, sought by agreement, collusion, communication, or conference with any other bidder, firm or person to fix the price or prices in the attached bid or of any other Bidder; to fix any overhead, profit, or cost element 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 the City or any person interested in the proposed contract; and

(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 of the bidder’s agents, representatives, owners, employees, or parties in interest, including this affiant.

Signed______________________________________

Subscribed and sworn to before me this ________ day of ________________, ________.

_______________________________________
(Title)

_______________________________________
(Signature)

My Commission expires_______________________
CITY OF CHEYENNE BID BOND FORM

<table>
<thead>
<tr>
<th>PROJECT</th>
<th>Happy Jack Landfill Phase 2, Cells 1 and 2 Construction and Cell 3 Excavation Earthworks</th>
</tr>
</thead>
<tbody>
<tr>
<td>BID NUMBER</td>
<td>S-6-21</td>
</tr>
</tbody>
</table>

KNOW ALL MEN BY THESE PRESENTS, that____________________________, as Principal, and_________________________________________, as Surety, a corporation duly organized under the laws of the State of ____________ and authorized to do business within the State of Wyoming, are held and firmly bound unto the City of Cheyenne, Wyoming, in the full and just sum of ___________________________________Dollars ($________________), lawful money of the United States, for the payment of which sum, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, said Principal is herewith submitting a Proposal for___________________________________

________________________________________

_________________, and the City of Cheyenne, Wyoming has required as a condition for submitting said Proposal, that said Principal deposit specified Bid Security in an amount not less than five percent (5%) of the amount of said Proposal, conditioned that in event of failure of Principal to execute the contract and furnish the required performance and payment bonds if the contract is awarded to said Principal, that said sum be paid immediately to the City of Cheyenne, Wyoming as liquidated damages, and not as penalty, for the Principal’s failure to perform.

The condition of this obligation is such that if the aforesaid Principal will, within the time required, enter into a formal contract and give such bonds as are specified in the bidding documents with surety acceptable to the City; or if Principal shall fail to do so, pay to the City the sum determined herein as liquidated damages and not as a penalty, then this obligation shall be void; otherwise to remain in full force and effect.

Signed, sealed, and delivered this ______day of__________, _____.

Witness

Principal (seal)

by______________________________

Title______________________________

Witness

Surety (seal)

by______________________________

Attorney-in-fact

(Attach Power of Attorney)
List all materials suppliers and subcontractors proposed for this project and return list with bid:

**ATTENTION!**
Any Resident Bidder using Non-Resident subcontractors must fill in the percentage of work being done by the subcontractor.

<table>
<thead>
<tr>
<th>WORK</th>
<th>SUBCONTRACTOR OR MATERIAL SUPPLIER</th>
<th>CITY/STATE</th>
<th>% OF WORK</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
BID SUBMISSION CHECKLIST

THE FOLLOWING CHECKLIST REPRESENTS THE REQUIRED FORMS TO BE EXECUTED AND DOCUMENTS TO PREPARE. THESE FORMS AND DOCUMENTS ARE TO BE INCLUDED IN THE CONTRACTOR’S SUBMITTED BID PACKAGE.

COMPLETED & INCLUDED

1. City of Cheyenne Bid Proposal Form [  ]
2. Bid Price Total [  ]
3. Itemized Bid Schedule [  ]
4. Sub-Contractors and Material Suppliers List [  ]
5. Non-Collusion Affidavit of Prime Bidders [  ]
6. Bid Security / Bid Guarantee [  ]
7. Acknowledgement of Addenda (If Any) [  ]
PART 4 - NOTICE OF AWARD, NOTICE TO PROCEED, AND OTHER FORMS
CITY OF CHEYENNE, WYOMING

**CITY OF CHEYENNE**

**BID ACCEPTANCE FORM**

<table>
<thead>
<tr>
<th>BID NUMBER:</th>
<th>S-6-21</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATE:</td>
<td></td>
</tr>
<tr>
<td>TO:</td>
<td></td>
</tr>
</tbody>
</table>

To Whom It May Concern:

The City of Cheyenne, having duly considered the proposals submitted on ___/____/____ for the construction of “Happy Jack Landfill Phase 2, Cells 1 and 2 Construction and Cell 3 Excavation Earthworks”, as outlined in these Contract Documents, and it appearing that your Proposal for performing the work outlined is fair, equitable, and in the City’s best interest, the bid items are hereby accepted at the bid prices contained therein.

In accordance with the terms of these Contract Documents, you are required to execute the formal Agreement and furnish the required Performance and Payment Bonds within thirty (30) calendar days from and including the date of this notice.

In addition, you are required to furnish at the same time a copy of Certificate of Insurance evidencing compliance with the requirements for insurance stated in the Bidding Documents, including unemployment insurance, and a copy of your Worker’s Compensation Certificate.

The Bid Guarantee submitted with your Proposal will be retained until the Agreement has been executed and the required Performance and Payment Bonds have been furnished and approved. In event that you should fail to execute the contract and furnish the Performance and Payment Bonds within the time limit specified, the said bid security will be retained as liquidated damages and not as penalty for the delay and extra work caused thereby.

CITY OF CHEYENNE, WYOMING

By____________________________________

Purchasing Manager
You are hereby authorized to proceed on this date, _______________ with the construction of “Happy Jack Landfill Phase 2, Cells 1 and 2 Construction and Cell 3 Excavation Earthworks” as set forth in detail in the Contract Documents. No work may be done at the site prior to the date stated above.

CITY OF CHEYENNE, WYOMING

By________________________

Purchasing Manager

The Contractor is required to return an acknowledged copy of this Notice to the City.

Acknowledged:

<table>
<thead>
<tr>
<th>Contractor:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>By [Printed Name]:</td>
<td></td>
</tr>
<tr>
<td>By: [Signature]:</td>
<td></td>
</tr>
<tr>
<td>Title:</td>
<td></td>
</tr>
<tr>
<td>Date:</td>
<td></td>
</tr>
</tbody>
</table>
CITY OF CHEYENNE CONTRACTOR’S
CERTIFICATION OF COMPLETION FORM

DATE: 

PROJECT: Happy Jack Landfill Phase 2, Cells 1 and 2 Construction and Cell 3 Excavation Earthworks

JOB NUMBER: 

CONTRACT NUMBER: 

OWNER: 

FROM: 

This is to certify that I, ______________________________, am an authorized official of ______________________________, working in the capacity of ______________________________, and have been properly authorized by said firm or corporation to sign the following statements pertaining to the subject contract:

I know of my own personal knowledge, and do hereby certify, that the work of the contract described above has been performed, and materials used and installed in every particular, in accordance with, and in conformity to, the contract drawings and specifications.

The contract work is now complete in all parts and requirements, and ready for your final inspection.

I understand that neither the determination by the Engineer/Architect that the work is complete, nor the acceptance thereof by the Owner, shall operate as a bar to claim against the Contractor under the terms of the guarantee provisions of the Contract Documents.

BY: ______________________________

TITLE: ______________________________

FOR: ______________________________
## CITY OF CHEYENNE
### CONSENT OF SURETY FOR FINAL PAYMENT FORM

<table>
<thead>
<tr>
<th>PROJECT NAME:</th>
<th>Happy Jack Landfill Phase 2, Cells 1 and 2 Construction and Cell 3 Excavation Earthworks</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOCATION:</td>
<td></td>
</tr>
<tr>
<td>PROJECT NUMBER:</td>
<td><strong>S-6-21</strong></td>
</tr>
<tr>
<td>TYPE OF CONTRACT:</td>
<td></td>
</tr>
<tr>
<td>AMOUNT OF CONTRACT:</td>
<td></td>
</tr>
</tbody>
</table>

In accordance with the provisions of the above-named contract between the Owner and the Contractor, the following named surety:

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

On the Payment Bond of the following named Contractor:

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

hereby approves of final payment to the Contractor, and further agrees that said final payment to the Contractor shall not relieve the Surety Company named herein of any of its obligations to the following named Owner as set forth in said Surety company’s bond:

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

IN WITNESS WHEREOF, the Surety Company has hereunto set its hand and seal this _______ day of ____________________, ________.

____________________________
(Name of Surety Company)

____________________________
(Signature of Authorized Representative)

(Affix corporate seal here)

Title ________________________________
TO ALL WHOM IT MAY CONCERN:

WHEREAS, the undersigned has been employed by

A. 

to furnish labor and materials for

B. 

work, under a contract

C. 

for the improvement of the premises described as

D. 

in the City of Cheyenne, Laramie County, Wyoming, of which the City of Cheyenne is the Owner.

NOW, THEREFORE, this ____ day of ______________, _____, for and in consideration of the sum of

E. 

dollars, paid simultaneously herewith, the receipt whereof is hereby acknowledged by the undersigned, the undersigned does hereby waive and release any lien rights to, or claim of lien with respect to and on said above-described premises, and the improvements thereon, and on the monies or other considerations due or to become due from the owner, on account of labor, services, material, fixture, apparatus or machinery heretofore or which may hereafter be furnished by the undersigned to or for the above described premises by virtue of said contract.

(F)___________________________________ (SEAL)

(Name of sole ownership, corporation or partnership)

_____________________________________

(Signature of Authorized Representative)

TITLE: ____________________________________

**INSTRUCTIONS FOR FINAL WAIVER:**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>Person or firm with whom you agreed to furnish either labor, or services, or materials, or both.</td>
</tr>
<tr>
<td>B.</td>
<td>Fill in nature and extent of work; strike the word labor or the word materials if not in your contract.</td>
</tr>
<tr>
<td>C.</td>
<td>If you have more than one contract on the same premises, describe the contract by number if available, date and extent of work.</td>
</tr>
<tr>
<td>D.</td>
<td>Furnish an accurate enough description of the improvement and location of the premises so that it can be distinguished from any other property.</td>
</tr>
<tr>
<td>E.</td>
<td>Amount shown should be the amount actually received and equal to total amount of contract as adjusted.</td>
</tr>
<tr>
<td>F.</td>
<td>If waiver is for a corporation, corporate name should be used, corporate seal affixed and title of officer signing waiver should be set forth; if waiver is for a partnership, the partnership name should be used, partner should sign and designate himself as partner.</td>
</tr>
</tbody>
</table>
TO ALL WHOM IT MAY CONCERN:

WHEREAS, the undersigned has been employed by __________________________ to furnish labor and materials for __________________ work, under a contract _________________ for the improvement of the property described as __________________________________________

in the city/town of ___________, County of ____________, State of ______________ of which ________________________ is the Owner.

NOW, THEREFORE, this _______ day of ________________, _____, the undersigned, as the Contractor for the above-named contract pursuant to the conditions of the contract hereby certifies that to the best of his knowledge, information and belief, except as listed below, the Releases or Waivers of Lien attached hereto include the Contractor, all Subcontractors, all suppliers of materials and equipment, and all performers of work, labor or services, who have or may have liens against any property of the Owner arising in any manner out of the performance of the contract referenced above.

Exceptions: (List names of suppliers and/or subcontractors and amounts owed. If none, write “None.”) The City will withhold the amounts listed below from final payment due the Contractor until these obligations have been satisfied.

CONTRACTOR ________________________________________ (SEAL)

(Name of sole ownership, corporation or partnership)

(Affix corporate seal here)

________________________________________(SEAL)

(Signature of Authorized Representative)

TITLE:______________________________________________

ATTACHMENTS:

1. Contractor’s Release or Waiver of Liens, conditional upon receipt of final payment.
2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers.
TO ALL WHOM IT MAY CONCERN:

WHEREAS, the undersigned has been employed by ___________________ to furnish labor and materials for ______________________________ (work) under contract #_________ for the improvement of the property described as ___________________________________________ in the city/town of ____________, County of _____________, State of ____________ of which ______________________________ is the Owner.

NOW, THEREFORE, this ____ day of ______________, _____, the undersigned, as the Contractor for the above-named Contract pursuant to the Conditions of the Contract hereby certifies that, except as listed below, he has paid in full or has otherwise satisfied all obligations for all materials and equipment furnished, for all work, labor, and services performed, and for all known indebtedness and claims against the Contractor for damages arising in any manner in connection with the performance of the Contract referenced above for which the Owner or his property might in any way be held responsible.

EXCEPTIONS: (If none, write “None.” If required by the Owner, the Contractor shall furnish bond satisfactory to the Owner for each exception.)

ATTACHMENTS:
I. Consent of Surety to Final Payment. (Whenever Surety is involved, Consent Of Surety is required.)
II. Contractor’s Release or Waiver of Liens, conditional upon receipt of final payment.
III. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers.
IV. Contractor’s Affidavit of Release of Liens.

CONTRACTOR _____________________________________________(SEAL)
(Name of sole ownership, corporation or partnership)

(Affix corporate seal here)

___________________________________________(SEAL)
(Signature of Authorized Representative)

TITLE: ___________________________________________
CITY OF CHEYENNE

CONTRACT PAYMENT REQUEST
FORM

DATE:

PROJECT: Happy Jack Landfill Phase 2, Cells 1 and 2 Construction and Cell 3 Excavation Earthworks

CITY BID NUMBER: S-6-21

CITY CONTRACT NUMBER:

CONTRACTOR:

CONTRACT PAYMENT REQUEST NUMBER:

FOR WORK COMPLETED THROUGH DATE OF:

The present status of the account for this contract is as follows:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original Contract Amount</td>
<td>$</td>
</tr>
<tr>
<td>Net Change by Change Orders to Date</td>
<td>$</td>
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<tr>
<td>Current Contract Amount</td>
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<td>Total Completed to Date</td>
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<td>Less 5% Retainage</td>
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<td>Total Earned Less Retainage</td>
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<td>Less Previous Payments</td>
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<td>Total Payment Due</td>
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<td>Total Retainage Due</td>
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Contractor’s Certification:

The undersigned Contractor certifies that: (1) all previous progress payments received from the City on account of work done under the Contract referred to above have been applied to discharge Contractor’s legitimate obligations incurred in connection with work covered by prior Contract Payment Request numbered one through ____ inclusive: (2) title of all work, materials and equipment incorporated in said work or otherwise listed in or covered by this Contract Payment Request will pass to Owner at the time of payment free and clear of all Liens, security interests and encumbrances (except such as are covered by Bond acceptable to owner indemnifying Owner against such liens, security interest or encumbrance); and (3) all work covered by this Contract Payment Request is in accordance with the Contract Documents and not defective.

____________________________________
Date

____________________________________
Authorized Signature
Print Name and Title

Payment of the above AMOUNT DUE THIS PAY REQUEST is recommended.

____________________________________
Project Manager Signature
Print Name and Title

Authorization by City Representative

____________________________________
City Representative Signature
Print Name and Title
CONTRACTOR:       

PROJECT: Happy Jack Landfill Phase 2, Cells 1 and 2 Construction and Cell 3 Excavation Earthworks

PAY REQUEST NUMBER:

This form must be submitted with the above pay request, or submit AIA document G702 and G703.

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
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<tbody>
<tr>
<td>Description of Work/Material</td>
<td>Unit</td>
<td>Original QTY</td>
<td>Original Contract Price</td>
<td>Original Contract Price</td>
<td>QTY Complete This period</td>
<td>Total Complete This period</td>
<td>QTY Complete from Previous Period</td>
<td>Total Complete From Previous Period</td>
<td>Total Complete (G+I)</td>
<td>Balance to finish</td>
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Signature:__________________________________________
Print Name:__________________________________________

City of Cheyenne / Bid S-6-21 / Page 32 of 325
THIS AGREEMENT, entered into this ___ day of __________, _____, by and between the CITY OF CHEYENNE, WYOMING, hereinafter referred to as the “CITY”, and __________________________________________, hereinafter referred to as the “CONTRACTOR”.

WITNESSETH that the Contractor and the City, for the considerations stated herein, mutually agree as follows:

ARTICLE 1. STATEMENT OF WORK. The Contractor shall furnish all supervision, technical personnel, labor, materials, machinery, tools, equipment, and services, including utility and transportation services, and perform and complete all work in an efficient and workmanlike manner in the construction of the “Happy Jack Landfill Phase 2, Cells 1 and 2 Construction and Cell 3 Excavation Earthworks” project all in strict accordance with the Contract Documents including all addenda thereto, numbered and dated:

ARTICLE 2. RESPONSIBLE DESIGNEEN FOR THE CITY. The Contractor shall in any and all matters relating to the scope of services to be provided under this Contract or any other provisions herein, contact the City Engineer, or his/her designated representative.

ARTICLE 3. TIME FRAME FOR COMPLETION. The services to be performed under this Agreement shall commence on the date stipulated in the “Notice to Proceed” that will be issued by the City. The work shall be completed by ______________. If the work has not been completed within the time stipulated above, including any extensions of time issued by the City for excusable delays, the Contractor and his/her sureties shall pay the City fixed, agreed liquidated damages, as stipulated in the Supplemental Conditions, for each calendar day of delay until the work is completed.

ARTICLE 4. COMPENSATION AND METHOD OF PAYMENT. The CITY will pay the Contractor for the performance of the Contract in current funds, the sum of ________________________________ Dollars ($___________). In the event there are changes in the estimated quantities shown on the Bid Proposal, the unit prices multiplied by the actual quantities shall govern, and the total contract amount will be adjusted accordingly. The City agrees to pay the above amount for contractual services in the following manner, upon receipt of appropriate documentation:

a. The Contractor will be paid on a monthly basis for percentage of estimated work completed. Submittal will be at least seven (7) business days prior to the payable due date as established.
annually by the City Treasurer’s Office. The pay request shall be submitted on the Contract Payment Request Form and Itemized Pay Request or the AIA Documents G702 and G703. The engineer will review the estimate for approval prior to payment.

b. The City will withhold five percent (5%) of the dollar value of the work completed for a minimum of forty-one (41) calendar days after Notice of Final Settlement has been published in accordance with Wyo. Stat. §15-1-113(h). Upon completion of the work under this Contract, the Contractor shall submit a Contractor’s Certificate of Completion; the Consent of Surety; Final Waivers of Lien from the Contractor, and all Sub-Contractors, Suppliers and Materialmen; Affidavit of Release of Liens; Affidavit of Payment; and a current Workers Compensation Certificate. Final payment will not be made until the above documents have been received by the City and all items on the Punch List have been completed, and the advertising requirements have been met.

**ARTICLE 5. CONTRACT.** The executed Contract Documents shall consist of the following:

1. This Agreement;
2. Addenda;
3. Invitation for Bids;
4. Instructions to Bidders;
5. Signed Bid Proposal;
6. General Conditions and Insurance;
7. Supplemental Conditions;
8. Part IV Forms & Notices;
9. Specifications and Special Provisions;
10. Drawings.

This Agreement, together with other documents enumerated in this Article 5, which said other documents are as fully a part of the Contract as if hereto attached or herein repeated, forms the Contract between the parties hereto.

IN WITNESS WHEREOF, THAT the governing body of the City of Cheyenne has authorized the Mayor as Executive Officer of the City to enter into this Agreement, and that the parties hereto have caused this Agreement to be executed on the day and year in the first part herein written.

**ATTEST:**

____________________________
Kristina F. Jones, City Clerk

____________________________
Marian J. Orr, Mayor

Notary or Corporation Secretary:

SUBSCRIBED AND SWORN TO BEFORE ME

this ___ day of ________, ___

by____________________________________

My Commission expires:_________

City of Cheyenne / Bid S-6-21 / Page 34 of 325
|   | CITY OF CHEYENNE  
|---|---
|   | PERFORMANCE AND PAYMENT 
|   | BOND REQUIREMENTS |
| 1. | Signature of principal must be affixed to the bond. |
| 2. | Signature of principal must be witnessed. |
| 3. | Name of principal must be witnessed. |
| 4. | The legal capacity of the principal must be stated in the caption of the bond (i.e., corporation, partnership or sole proprietorship). |
| 5. | If the principal is jointly owned, all owners must sign the bond. |
| 6. | If the principal is a partnership, at least two partners must sign the bond. |
| 7. | Signature of the attorney-in-fact acting on behalf of the surety company must appear on the bond. |
| 8. | The surety’s seal must be affixed to the signature of the attorney-in-fact (Facsimile seals are NOT acceptable). |
| 9. | The surety company must be registered with the state insurance commission and qualified to do business in the State of Wyoming. |
| 10. | Power of Attorney/Acknowledgment of Surety must be signed, sealed and dated with the same date as execution of bond. |
| 11. | Date of written Agreement and date of bond must be same. Post-dated bonds are not acceptable. |
| 12. | Bond form must be completely executed. Bonds with blank spaces, including dates, are unacceptable. |
| 13. | The bond must be accompanied by a properly executed authorization of Power of Attorney. **Note:** The bond shall continue in force throughout the project and a two-year warranty period; and at the discretion of the City, for any additional warranty period specified in the contract documents. |
| 14. | The person signing on behalf of the corporate principal must state his/her legal capacity and he/she must be either the president or the vice-president if it is a corporation. If the officer or person signing on behalf of the corporate principal is other than the president or vice-president, there must be attached to the bond a resolution or certified evidence of authority that such officer or person has authority to sign in behalf of the principal. |
| 15. | The signature of the principal must be witnessed, or attested to if it is a corporate principal by ONLY the secretary or assistant secretary of the corporation. |
| 16. | The corporate seal must be affixed to the signature of the principal. (Facsimile seals are NOT accepted). |
| 17. | Each party is required to sign his/her own name. |
| 18. | All changes or strike-throughs must be initialed by the resident agent or attorney-in-fact of the surety company. The surety company must be notified of such changes. |
KNOW ALL MEN BY THESE PRESENTS:

That

_____________________________________________________________________
(Name of Contractor)

_____________________________________________________________________
(Address of Contractor)

a _____________________________________, hereinafter called Principal,

and ___________________________________ hereinafter called Surety, are

(Name of Surety)

held and firmly bound unto the City of Cheyenne, Wyoming, Municipal Building, 2101 O’Neil Avenue, hereinafter called City, in the penal sum of:

___________________________________________________________ Dollars

($____________________), in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, successors and assigns, 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 City, dated the _____ day of ___________, _____, a copy of which is hereto attached and made a part hereof for the

_____________________________________________________________________________.

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms and conditions, and agreements, of said contract during the original term thereof, and any extensions thereof which may be granted by the City, with or without notice to the Surety and during the two-year guarantee period, and if the Principal shall satisfy all the claims and demands incurred under such contact, and shall fully indemnify and save harmless the City from all costs and damages which the City may suffer by reason of failure to do so, and shall reimburse and repay the City all outlay and expense which the City may incur in making good any default, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said Surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract or to work to be performed thereunder or the specifications accompanying the same shall in any wise affect its obligation on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of this contract or to the work or to the specifications.

PROVIDED, FURTHER, that no final settlement between the City and the Contractor shall abridge the right of any beneficiary hereunder whose claim may be unsatisfied.
IN WITNESS WHEREOF, this instrument is executed in ___ counterparts, each one of which shall be deemed an original, this the ___ day of ____________, _____.

_____________________________ (Witness)

_____________________________ (Principal) (Seal)
By_____________________________ (Title)
By_____________________________ (Address)

_____________________________ (Witness)

_____________________________ (Surety) (Seal)
By_____________________________ (Attorney-in-fact)
By_____________________________ (Address)

Countersigned by:

By_____________________________ (Wyoming Resident Agent)
By_____________________________ (Address)

NOTE: Date of Bond must be same date as date of Contract. If Contractor is a partnership, all partners must execute bond.

IMPORTANT: Surety companies executing bonds must hold a Certificate of Authority issued by the State of Wyoming Insurance Department.
PART 6 – GENERAL CONDITIONS
CITY OF CHEYENNE, WYOMING

1.00 PROJECT SITE

City of Cheyenne Landfill, 1461 Happy Jack Rd, Cheyenne, WY 82009

2.00 NOTICES

Any notice, correspondence, or billing required by the terms of this Agreement shall be delivered by hand or mail, prepaid, to the address of the respective party representative(s) named below:

CITY: Matt Theriault
Public Works / Landfill
2101 O'Neil Ave.
Cheyenne, WY 82001
Ph: 307-637-6279

3.00 DRUG-FREE WORKPLACE

In compliance with the Drug Free Work Place Act of November 1988, the City has established an “Alcohol and Controlled Substance Policy” that pertains to alcohol and drug usage by City employees. All independent contractors under contract with the City and their employees and subcontractors are required to comply with the provisions of this policy for drug and/or alcohol usage on City property or other sites occupied by the Contractor while performing the duties and responsibilities of the contract. It is the responsibility of the Contractor to become familiar with the requirements of this policy and to inform all subcontractors and employees of their obligation to comply and to ensure their compliance therewith. If the Contractor, the Contractor’s employees, or subcontractors are found in violation of this policy, the contract may be terminated. The Contractor is an independent Contractor and shall comply with the City’s Alcohol and Controlled Substance Policy and the provisions of this section.

4.00 NONDISCRIMINATION

The parties shall comply with the Civil Rights Act of 1964, the Wyoming Fair Employment Practices Act (Wyo. Stat. § 27-9-105 et seq.), the Americans With Disabilities Act (ADA (42 U.S.C. § 12101 et seq.)), the Age Discrimination Act of 1975, and any properly promulgated rules and regulations thereto and all parties to this Agreement assure that no person shall be excluded from participation in, denied the benefits of, or otherwise discriminated against in connection with the award and performance of this Agreement on the grounds of age, sex, race, creed, color, national origin, ancestry, religion, pregnancy, qualifying disability, sexual orientation, or gender identity. The parties further assure that they will include the language of this paragraph in all agreements associated or connected in any way with this Agreement and shall cause all existing Agreements to similarly include this clause therein.
5.00 CONTRACTS FOR PUBLIC IMPROVEMENTS

Wyo. Stat. § 15-1-113 is expressly incorporated herein by this reference as though fully set forth herein.

6.00 SAFETY PROGRAMS

The City, as mandated by Occupational Safety and Health Administration (“OSHA”), has in place many safety programs. All independent contractors, their employees, and their subcontractors, under contract with the City, must be familiar with and comply with any and all applicable OSHA standards, regulations, and provisions.

7.00 INDEPENDENT CONTRACTOR

At all times during the term of this Agreement, the Contractor shall be considered an independent contractor. Neither Contractor nor any one employed by it shall represent, act, purport to act, or be deemed to be the agent, representative, employee, or servant of the City.

8.00 CONFIDENTIALITY

To the extent allowed by law, the City and the Contractor shall treat as confidential and not disclose to others information (including technical information, experience, or data) regarding either party’s plans, programs, plants, processes, products, costs, equipment, operations, or customers which come within the knowledge of the parties, without in each instance securing the prior written consent of the other party, unless such disclosure is required by law or legal process. However, nothing shall prevent either Contractor or the City from disclosing to others, or using in any manner, information which either party can show (a) has been published or has become part of the public domain other than by acts of Contractor or the City; (b) has been furnished or made known to Contractor or the City by third parties without restrictions on its disclosure; or (c) was in either party’s possession prior to the disclosure thereof by the City or Contractor to each other. Contractor shall not be restricted in any way from releasing information in response to a subpoena, court order, or legal process, but shall notify City of the demand for information before Contractor responds to such demand. The City reserves the right to prohibit the release of said information as provided by law.

9.00 CONFLICT OF INTEREST

In entering this Agreement, the Contractor covenants that it presently has no interest, and shall not acquire any interest, direct, indirect, financial, or otherwise, which would conflict in any manner or degree with performance of the services hereunder. Contractor further covenants that in the performance of the Agreement, no subcontractor, or person having such an interest, shall be employed by the City. Contractor certifies that no one who has or will have any financial interest under this Agreement is an officer or employee of the City.
10.00  **ACCEPTANCE NOT WAIVER**

The City’s approval of drawings, plans, specifications, reports, and incidental work, or materials furnished hereunder shall not in any way relieve Contractor from responsibility for the technical accuracy of the work. The City’s approval or acceptance of, or payment for, any services shall not be construed to operate as a waiver of any of the City’s rights under this Agreement or any of its legal rights under statute and common law arising out of the performance of this Agreement.

11.00  **INSURANCE REQUIREMENTS**

The Contractor shall file a Certificate of Insurance with the City verifying each type of insurance coverage listed below.

The Certificate of Insurance shall be submitted to and approved by the City before the Contractor begins to perform under this bid and the subsequent contract.

<table>
<thead>
<tr>
<th>TYPE OF COVERAGE</th>
<th>MINIMUM POLICY REQUIREMENTS</th>
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<tbody>
<tr>
<td>Commercial General Liability</td>
<td>$1,000,000 per Occurrence</td>
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<tr>
<td>(Including Products and Completed</td>
<td>$2,000,000 Aggregate</td>
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<td>Operations; Explosion, Collapse and Underground if</td>
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<td>applicable to the hazards of a specific project)</td>
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<tr>
<td>Business Automobile Liability</td>
<td>$1,000,000 (Combined Single Limit)</td>
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<tr>
<td>Workers’ Compensation</td>
<td>Statutory</td>
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<td>OR</td>
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<tr>
<td>Employer’s Liability</td>
<td>$500,000 Each Accident</td>
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<td></td>
<td>$500,000 Each Disease-Policy Limit</td>
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<td>$500,000 Disease/Each Employee</td>
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It is understood and agreed that these policies are primary and not contributory. All policies required under this contract shall be in effect for the duration of the project and contract. The Contractor shall immediately notify in writing the City Risk Manager, City Clerk, and City Attorney of any fact, circumstance, or occurrence that has resulted in, or may result in, the cancellation or substantive change of any insurance coverage required by this contract, and failure to do so shall be construed to be a breach of this contract.

The Contractor shall name the City as an additional insured on the Contractor’s insurance policies, except workers’ compensation, and the Contractor shall provide a copy of the endorsements providing this coverage.

The City has the right to reject a certificate of insurance if the City determines that the Contractor’s insurance company is widely regarded in the insurance industry as financially unstable. Any insurance company providing coverage under this contract shall have a minimum A.M. Best rating of A- (excellent).
The City has the right to review the insurance certificates of any or all Sub-Contractors used by the Contractor. Further, the City requires that the Sub-Contractors’ insurance coverages be at least equivalent to that required of the Contractor.

The City has the right to increase the required minimum limit of liability on any contract project as warranted by an increase in hazard. Examples of increased hazard include, but are not limited to, handling of hazardous materials and activities involving large congregations of people.

The City shall have the right to consult with the Contractor’s insurance agent for disclosure of relevant policy information, but the City’s non-request or non-review such policies, endorsements, or certificates shall not affect the City’s rights or Contractor’s obligations hereunder. Disclosure of relevant policy information would specifically involve, but is not limited to, exclusions, deductibles, and claims in progress which could significantly reduce the annual aggregate limit.

**12.00 INDEMNITY**

In entering into the Agreement, the Contractor agrees to hold harmless, defend, and indemnify the City of Cheyenne, its officials, employees, agents, and authorized volunteers against any and all claims and costs, including attorneys’ fees, arising during or resulting from the Contractor’s performance of the contract. The Contractor shall carry insurance as set forth in these Contract Documents. The Contractor acknowledges its understanding of this paragraph and realizes it may have a financial responsibility to the City. The City does not waive any applicable defenses and expressly reserves the right to invoke governmental immunity pursuant to the Wyoming Governmental Claims Act, Wyo. Stat. § 1-39-101, et seq. for any claim arising out of performance of this agreement.

The Contractor expressly understands and agrees that although the City and the Engineer have the right under this Contract to observe and review the Contractor’s work and operations, this right shall not relieve the Contractor from any of its covenants, obligations, or duties hereunder. The Contractor shall be responsible for and hold harmless the City, the Engineer, and their representatives from all suits, actions, or claims of any character, due to injuries or damages sustained by any person or property, in consequence of any neglect in performing the work, observing safety standards or regulations, through the use of unsafe or unacceptable practices or materials in the performance of the work, the Contractor’s failure to comply with any law, ordinance or regulation or otherwise.

**13.00 PROJECT RECORD DOCUMENTS**

The Contractor shall maintain at the job site one copy of all Contract and project documents, each portion of which shall be clearly marked, “Project Record Copy”. These documents, including drawings, specifications, addenda, approved shop drawings, change orders, field orders, other Contract Modifications, and other approved documents submitted by the Contractor in compliance with various sections of the Contract Documents, shall be maintained in good condition, available at all times for inspection by the City, and not used for construction purposes.

The Contractor shall mark up the most appropriate document to show significant changes made during construction progress, and significant detail not shown in the original Contract
Documents. The information shall include, but shall not be limited to, location of underground utilities and appurtenances referenced to permanent surface improvements, and location of internal utilities and appurtenances concealed in building structures referenced to visible and accessible features of structures.

The Contractor shall keep the project record documents current and not permanently conceal any work until required information has been recorded. Upon completion of the project and prior to final acceptance, the Contractor shall submit the marked up set of project record documents to the Engineer for the City along with the “Contractor’s Certificate of Completion” found in the bidding documents. After the Engineer has inspected the work and has determined it to be substantially complete, the City will issue a “Certificate of Substantial Completion”, which will establish the date of commencement of the warranty period.

14.00 CONTRACT DOCUMENTS

The City will furnish to the Contractor, without charge, two (2) copies of the Contract Documents including technical specifications and drawings. Additional copies requested by the Contractor will be furnished at cost.

15.00 TIME FOR COMPLETION

The Contractor shall commence the work required under this contract at the time stipulated by the City in the Notice to Proceed. The Contractor shall complete the work by the following:

Earthworks Contractor

November 1, 2020 to September 30, 2021

Earthworks Milestones

Notice to Proceed – November 1, 2020

a) Excavation (Subgrade and anchor trenches ready for liner installation) – November 1, 2020 - July 1, 2021 (242 calendar days)

b) Liner Installation Support (they will be able to backfill anchor trenches and place drainage layer material during part of this time) – July 1, 2021 – August 31, 2021 (61 calendar days)

c) LCRA System, Drainage Layer, and Reclamation – August 31, 2021 – October 31, 2021 (61 calendar days)

Geosynthetics Installer

July 1, 2021 – August 31, 2021 (61 calendar days)

Time will not be counted when the project is officially suspended by the City due to acts of God, winter shutdown, and City-originated suspensions that are necessary through no
fault of the Contractor. In the latter instance, if the City suspends the work for more than ninety (90) calendar days, the Contractor may apply for a price adjustment to compensate for reasonable expenses caused by the suspension. Any application for price adjustment or Contract Time extension will be submitted to the Governing Body of the City for its consideration in the form of a Contract Modification. It will be the responsibility of the Contractor to provide sufficient documentation to substantiate any claim.

16.00 JOB OFFICES AND STAGING AREA

The Contractor and Sub-Contractor(s) may maintain office and storage facilities on the site which are necessary to properly conduct the work. These facilities’ locations shall not cause any interference to any work performed on the site. The Contractor shall consult with the City regarding the locations. Upon completion of the improvements, or as directed by the City, the Contractor shall remove all such temporary structures and facilities from the site. The Contractor shall leave the site of the work in the condition required by the Contract.

On-site toilet facilities for employees of Contractors and Sub-Contractor(s) shall be provided and maintained in a sanitary condition. The Contractor shall remove all trace of these facilities prior to completion of the project.

17.00 THE USE OF CITY OWNED REFUSE CONTAINERS

All City contracts shall require all Contractors to use City-provided Sanitation services if available.

18.00 REFERENCE POINTS

Project survey points are provided by the City one time only, unless otherwise noted by the City in the appropriate project manual.

The Contractor shall make all surveys that will be necessary for the proper construction. The Contractor shall preserve all property pins and control points. If any of these are destroyed or disturbed due to the Contractor’s construction activities or negligence, the Contractor will be charged at the Engineer’s established hourly crew rate for replacing them, with payment for this extra work to be made directly to the Engineer by deduction from the monthly periodic estimate payments to the Contractor. The Contractor shall also be responsible for any mistakes or damage resulting from the unnecessary loss or disturbances of control points.

19.00 SEQUENCE OF WORK

The Contractor shall make every effort to complete the work in a manner and fashion that minimizes roadway closures and inconveniences to the traveling public and adjacent property owners. Once barricades are placed in the right-of-way, the Contractor shall show progress of work during normal Working Days and hours. If no progress of work is recorded for twenty-four (24) hours and no concrete is waiting for strength, the Contractor shall remove barricades, re-open the right-of-way, and provide a safe travel way for the public. If the Contractor does not re-open the right-of-way or show progress of work within twenty-four (24) hours, the City shall use any and all means necessary to re-open the area.
at the Contractor’s expense. The Contract Documents are compiled to support the efficient operations of the Contractor and are not intended to supplant the Contractor’s responsibility of superintendence. Special consideration regarding schedules or work sequences necessary or anticipated during the course of the project will be identified in the Special Provisions.

20.00 GENERAL TRAFFIC REQUIREMENTS

The Contractor shall provide adequate signs, barricades, lights, and flaggers, and take all necessary precautions to prevent accident or injury and to minimize inconvenience to the public during the progress of the work.

All traffic control or other protective devices shall be installed and maintained in accordance with the Uniform Manual of Traffic Control Devices or in conformance with the applicable requirements of the authority having jurisdiction in such matters. The Contractor shall provide an American Traffic Safety Services Association (“ATSSA”) certified work site supervisor to supervise all traffic control operations if the City deems necessary.

Material stored on or adjacent to public streets shall not obstruct or inconvenience the traveling public.

Streets, driveways, or other access points shall not be closed without the prior consent of the City, Engineer, and proper governmental authorities. Fire hydrants on or near the site of the work shall be accessible at all times. The Contractor shall notify affected property owners, the City and the Engineer at least 48 hours in advance of any proposed closure for construction operations including any work to be done by utility companies.

The Contractor shall submit a traffic control diagram to the City for approval before work begins. The diagram shall indicate location and type of signs, cones, flashers, flagging, reflective barricades, and all other devices deemed necessary for the proper protection of the work area.

21.00 EXISTING ROADWAYS AND OTHER PROPERTY

The Contractor shall take all necessary precautions to protect adjacent roadways, properties, improvements, and underground facilities affected by the Contractor’s operations, regardless of the facilities’ ownership.

Any existing improvements or facilities damaged by the Contractor’s operations in the performance of the work under this Agreement shall be repaired or replaced by and at the expense of the Contractor to the satisfaction of the City.

The Contractor shall be responsible for the preservation and maintenance of all existing roadways affected but not directly disturbed by the work. The Contractor shall repair, replace, or clean any roadway indirectly affected by his or her operations during the course of the project. Such work shall be accomplished by and at the expense of the Contractor without reimbursement by the City.
22.00 **FINAL CLEANUP**

The Contractor shall clean all sidewalks, streets and other areas affected by construction and ensure removal of all loose surface materials. All piles of excess excavation, rocks, rubbish, or other debris shall be cleaned up and disposed of. Damage to any areas by the Contractor will be repaired or replaced by the Contractor at no expense to the City. No extra compensation will be allowed for final cleaning of the site, but the cost thereof shall be included in the unit price bid for other items in the Proposal. If work is suspended for any reason, the Contractor will be required at the Contractor’s expense, prior to shut down, to provide for the public’s safety and use as directed by the City or Engineer.

23.00 **ENGINEER OR INSPECTOR OVERTIME AND USE OF CITY RESOURCES:**

Inspection work required beyond normal working hours by any Engineer or Inspector having authority on the project must have the City’s written approval twenty-four (24) hours in advance of scheduled work. In emergency situations, verbal approval may be given followed by written approval on the next working day. In an emergency situation, verbal approval will suffice until the next working day at which time written approval will be obtained.

The City of Cheyenne Board of Public Utilities ("BOPU") requires that requests for services on the weekend be made not later than 4:30 p.m. on the Thursday prior to need so that appropriate personnel arrangements can be made.

All costs for overtime inspection or professional services associated with the work will be paid for by the Contractor.

No City services, equipment, or personnel will be provided for this project unless specifically defined and stated in the bidding or contract documents, nor will any be provided free of charge unless expressly stated in these documents.

24.00 **FORCE ACCOUNT, EXTRA WORK, AND WORK CHANGES**

When the Contractor is required to do work or services under the force account or extra work, the cost for said work will be calculated using the provisions of the Wyoming Department of Transportation system for determining costs for equipment, operators and labor involved. Any extra work, additions, deletions or revisions in the work will be authorized by written Contract Modification or change orders. The Engineer may authorize minor changes or alterations in the work not involving extra cost and not inconsistent with the overall intent of the Contract Documents in the form of a Field Order.

25.00 **CONTRACT MODIFICATIONS**

a. General: Contract Modifications are used to increase or decrease the total Contract Price, to alter the Contract Time, or to alter any other contract agreement provision. Each Contract Modification must be in writing, approved by the City’s Governing Body, and executed by the Mayor and Contractor.

b. A Contract Modification does not invalidate the contract or release the surety. If the parties agree to a Contract Modification, the Contractor shall perform the work
in the manner required by the contract as modified, except that the Contractor shall not perform any work which is subject to the Contract Modification, until such time as the City Engineer authorizes the Contractor to proceed. The City will initiate a request to modify the Contract by submitting the proposed Contract Modification to the Contractor for review and approval.

The City Engineer or agent thereof, e.g., a project manager, may issue a Field Order to authorize the work to be paid for under the Force Account bid item or to adjust existing bid item quantities without increasing the total Contract Price. See Section 24.00. The Contractor may not begin work under any Contract Modification until the City Engineer has authorized the Contractor to proceed.

The Contractor shall use a Request for Adjustment form to request an adjustment of the Contract Time or Contract Price. The City shall have no obligation to process oral requests for modification of the Contract Time or Contract Price, and no City official shall have the authority to approve oral modification requests. Proposed adjustments may be based upon extra work necessitated by an emergency, a change of conditions, or the City Engineer’s interpretation of the contract requirements. Requests for Adjustments shall not be valid unless the Contractor has filed the request with the Engineer within:

1. Two (2) Working Days after the occurrence of the emergency or the discovery of any change in conditions which necessitates Additional Work; or


The City will pay for adjustments and modifications based on contract unit bid prices. If the Contractor’s cost of production or the character of the work is materially changed, the City may adjust the contract as specified in this section or seek a Contract Modification. The City will not pay for loss of anticipated profits resulting from adjustments or modifications, unless so specified in the adjustment or modification.

Differing Site Conditions: Before the conditions are disturbed or the affected work is performed or continued, the Contractor shall notify the City in writing if either of the following is encountered: (1) latent physical conditions that differ materially from those indicated in the contract; or (2) unusual physical conditions that differ materially from those ordinarily encountered and generally recognized as inherent in the work provided for in the contract. The City will not grant or consider Contract Modifications based on differing site conditions if the Contractor does not timely notify the City within two (2) Working Days after discovering latent or unusual physical conditions.

Significant Changes in the Character of Work: The Contract Unit Price of each bid item in the proposal shall include the pro rata share of overhead and profit so that the sum of the products obtained by multiplying the quantity shown for each item by the unit price bid represents the total bid. The City may alter the contract quantities, the Work, or both as necessary to complete the project, subject to the requirement that modifications to the Contract Price may be necessary in the event the alterations significantly change the character of the work. If alterations do not significantly change the character of the work specified in the contract, the City will pay for the altered work at contract unit prices and additional mark-ups for overhead and profit are not allowed.
Either of the following constitutes a “significant change” (1) when the character of the work, as altered, differs materially in kind or nature from that specified in the contract; or (2) in accordance with the relevant section in the Instruction to Bidders, when the net monetary value of all such additive and subtractive changes in quantities of such items increases or decreases the original total Contract Price by more than twenty percent (20%).

Extra and Force Account Work: When necessary or desirable to complete the project, the City may direct the Contractor to perform unforeseen work for which there is no pay item or unit price in the contract. The City shall seek a Contract Modification in the event the City’s direction to perform unforeseen work results in an increase in the Contract Price, the alteration of the Contract Time or required any other modification of the Contract Agreement. The City Engineer may direct the Contractor to perform work under the Force Account item for minor changes or alterations in the work that do not increase the original Contract Price. All Force Account Work shall be approved with a Field Order in accordance with the above procedures.

Extra work under the Force Account item shall be paid by one of the following methods: (1) Contract unit bid prices that are representative of the work being performed, as specified in item Significant Changes in the Character of Work; and (2) Negotiated unit bid prices for items where the Contractor’s cost of production or the character of the work is materially changed. The negotiated unit bid prices shall include the pro rata share of overhead and profit. Overhead and profit mark-up on Sub-Contractor unit bid prices shall be limited to five percent (5%); (3) lump sum, as stipulated in the order authorizing the work. Documentation for lump sum pricing shall be provided to a degree sufficient for the City Engineer to review for acceptability. Overhead and profit shall be limited to five percent (5%) on Sub-Contractor work and fifteen percent (15%) on work by Contractor’s own forces; and (4) Time and material basis utilizing approved materials, equipment, and labor costs calculated under the provisions of the latest edition of the Wyoming Department of Transportation Specifications Subsection 109.4.4.

26.00 PARTIAL USE OF SITE IMPROVEMENTS

The City may give notice to the Contractor and place in use those sections of the improvements which have been completed, inspected, and can be accepted as complying with the Contract Documents if, in its opinion, each section is reasonably safe, fit and convenient for the use and accommodation for which it was intended, provided:

The use of such sections of the improvements shall in no way impede the completion of the remainder of the work by the Contractor;

The Contractor will not be responsible for any damages or maintenance costs due directly to the use of such sections;

The use of such sections shall in no way relieve the Contractor of liability arising from having used defective materials or to poor workmanship.

Any guarantee period shall not commence until the date of the final acceptance of all work which the Contractor is required to construct under this contract.
27.00 TWO YEAR WARRANTY PERIOD

If after the approval of final payment and prior to the expiration of two (2) years after the date of Substantial Completion or such longer period as may be prescribed by law or by the terms of any applicable special guarantee, the Contractor shall promptly, without cost to the City and in accordance with the City’s written instructions, either correct such defective work or, if it has been rejected by the City, remove it from the site and replace it with non-defective work within thirty (30) calendar days of written notification by the City. If the Contractor does not promptly comply with the terms of such instruction, the City may have the defective work corrected or the rejected work removed and replaced, and all costs incurred therefore, including compensation for additional professional services, shall be paid by the Contractor and its sureties. The remedies provided in this section are in addition to all other remedies available to the City under applicable law and shall not be construed as exclusive of any other legal right or remedy available to the City.

28.00 COMPLETION AND WARRANTY


Substantial Completion. Shall be defined as when the project can be safely and effectively used by the public for its intended use, without further delays, disruptions, or other impediments and only clean up and work of a minor nature remains to be finished, as agreed to by the City Engineer or as otherwise specified. After written notice from the Contractor of Substantial Completion, the Engineer and the City shall make a determination of acceptance of substantial completion. If in agreement, the City will issue written notice of Substantial Completion at which date the contract time will stop. The Engineer will then make an inspection of the project and develop a punch list of items to be completed. The Contractor will have thirty (30) calendar days to complete all punch list items, with the exception of seasonal work item, which will be as agreed by the Engineer and the City. Liquidated damages may be assessed by the City, in accordance with Section 29.00, for every day that expires after the allotted time for the completion of the punch list.

Warranty. The specified date in the City’s Notice of Substantial Completion issued to the Contractor shall be the effective date for the beginning of the two-year warranty period.

Final Completion. After completion of the punch list, the Contractor shall issue the Contractor’s Certificate of Completion along with the marked-up Project Record Drawings in accordance with Project Documents. At that time the Engineer and the City shall inspect and if all construction provided for and contemplated by the contract is found to be complete to their satisfaction, this inspection shall constitute the final inspection and the Engineer shall make the final acceptance. The Contractor shall be notified in writing as to the date of the Final Completion.

Prior to the end of the Warranty Period, the City shall inspect the Project for defects in the workmanship or material. A written deficiency list shall be developed and provided to the Contractor. Normal wear and tear shall not be considered a deficiency. The Contractor shall promptly, without cost to the City and in accordance with the City’s written instructions,
either correct such defective work or, if it has been rejected by the City, remove it from the site and replace it with non-defective work within thirty (30) calendar days of written notification by the City.

29.00 **LIQUIDATED DAMAGES**

For each calendar day that any work shall remain uncompleted after the contract time specified for the completion of the work provided for in the contract, the following liquidated damages charges will be deducted from any monies due the Contractor:

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<th>ORIGINAL CONTRACT AMOUNT</th>
<th>LIQUIDATED DAMAGE CHARGE</th>
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<td>and greater</td>
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Permitting the Contractor to continue and finish the work or any part of it after the time fixed for its completion, or after the use of additional contract time, will in no way constitute a waiver on the part of the City to any of its rights under the contract.

Unless otherwise provided in the contract, liquidated damage charges will be calculated in accordance with the table. All time in excess of the required Contract Time will be calculated on a calendar day basis.

30.00 **GOVERNMENTAL IMMUNITY**

The City and its officials and employees do not waive governmental immunity by entering into this Agreement and specifically retain all immunities and defenses available to them as Governmental Entities pursuant to Wyo. Stat. § 1-39-101, *et seq.*, and all other applicable laws. Further, the City fully retains all immunities and defenses provided by law with regard to any action, whether in tort, contract, or any other theory of law, based on this Agreement. The City does waive its governmental immunities solely for the enforcement of the terms and conditions of this Agreement.

31.00 **GOVERNING LAW, JURISDICTION, AND VENUE**

The construction, interpretation, and enforcement of this Agreement shall be governed by the laws of the State of Wyoming. The courts of the State of Wyoming shall have jurisdiction over any action arising out of this Agreement and over the parties, and the venue shall be the First Judicial District, Laramie County, Wyoming.
32.00 COMPLIANCE WITH LAWS

This Agreement shall be governed in all respects by the laws of the State of Wyoming. The parties hereto shall comply with all applicable federal, state, and local laws, rules, and regulations in the performance of this contract. The identified laws or regulations are included in this Agreement as mandated by statute or for the convenience of the Contractor. The Contractor’s attention is directed to the fact that all applicable federal and state laws, municipal ordinances, and the rules and regulations of all authorities having jurisdiction over design and construction of the project shall apply to the Agreement throughout, and they are deemed incorporated herein. Other laws and regulations apply which are not included herein, and are within the Contractor’s duty and responsibility for compliance therewith.

33.00 DEFAULT

Each and every term and condition herein shall be deemed a material element of this Agreement. In the event either party shall fail or refuse to perform according to the terms of this Agreement, such party may be declared in default.

34.00 REMEDIES

In the event a party declares the other party in default hereof, said party declaring default shall notify the defaulting party in writing, and such defaulting party shall be allowed a period of fifteen (15) calendar days to cure said default. In the event that the default remains uncorrected, the party not in default may elect to: (a) terminate this Agreement and seek damages; (b) treat this Agreement as continuing and require specific performance; or (c) avail itself of any other remedy at law or equity.

In the event Contractor fails to strictly perform in accordance with this Agreement, the City may elect to make good such deficiencies and charge Contractor therefore.

35.00 TERMINATION

The City may, by written notice to Contractor, terminate this Agreement, in whole or in part, by giving Contractor fifteen (15) calendar days written notice. Upon receipt of such notice, Contractor shall discontinue all services affected (unless the notice directs otherwise), and deliver to the City representative within five (5) calendar days all documents belonging to the City, including but not limited to, data, drawings, specifications, reports, estimates, and summaries accumulated by the Contractor in the performance of this Agreement, whether completed or in progress. In the event of termination, the City shall pay Contractor for all work accepted as of the date of termination.

36.00 WAIVER

The waiver by either party of any term, condition, or covenant, or breach of any term, condition, or covenant, shall not constitute a waiver of any other term, condition, or covenant, or breach thereof.
37.00 **SEVERABILITY**

If any provision, section, subsection, sentence, clause, or phrase of this Agreement is invalidated by any court of competent jurisdiction, such holding shall not affect the validity of the remainder of the Agreement, which shall continue in full force and affect.

38.00 **SUCCESSIONS AND ASSIGNS**

All the terms, conditions, and provisions herein shall inure to the benefit of and be binding upon the parties hereto and their respective successors and assigns.

39.00 **ASSIGNMENT**

Neither party shall assign this Agreement without prior written consent of the other party. Any delegation or assignment shall not operate to relieve either party of its responsibilities hereunder.

40.00 **THIRD PARTY RIGHTS**

The parties do not intend to create in any other individual or entity the status of third party beneficiary, and this Agreement shall not be construed so as to create such status. The rights, duties and obligations contained in this Agreement shall operate only between the parties to this Agreement, and shall inure solely to the benefit of the parties to this Agreement. The parties to this Agreement intend and expressly agree that only the parties signatory to this Agreement shall have any legal or equitable right to seek to enforce this Agreement, to seek any remedy arising out of a party’s performance or failure to perform any term or condition of this Agreement. This paragraph is not intended nor shall it be construed to waive all the parties’ immunities.

41.00 **FORCE MAJEURE**

The performance of the Agreement by either party shall be subject to force majeure including, but not limited to, acts of God, fire, flood, natural disaster, war or threat of war, acts or threats of terrorism, civil disorder, unauthorized strikes, governmental regulation or advisory, recognized health threats as determined by the World Health Organization, the Centers for Disease Control, or local government authority or health agencies (including, but not limited to, the health threats of COVID-19, H1N1, or similar infectious diseases), curtailment of transportation facilities, or other similar occurrence beyond the control of the parties, where any of those factors, circumstances, situations, or conditions or similar ones prevent, dissuade, or unreasonably delay the performance required by this Agreement. The Agreement may be cancelled by either party, without liability, damages, fees, or penalty, and any unused deposits or amounts paid shall be refunded, for any one or more of the above reasons, by written notice to the other party.
PART 7 - SPECIFICATIONS
CITY OF CHEYENNE, WYOMING

THE STANDARD SPECIFICATIONS GOVERNING THIS PROJECT SHALL BE THE “CITY OF CHEYENNE/BOARD OF PUBLIC UTILITIES CONSTRUCTION SPECIFICATIONS AND STANDARD DRAWINGS, 2014” WITH APPROVED AMENDMENTS ISSUED BY THE CITY ENGINEER AT THE TIME OF THIS CONTRACT.

IT IS THE CONTRACTOR’S RESPONSIBILITY TO KEEP CURRENT ON THESE AMENDMENTS. COPIES OF THESE AMENDMENTS ARE AVAILABLE ON THE CITY’S WEBSITE AT http://www.cheyennecity.org.

SPECIAL PROVISIONS

THE SPECIAL PROVISIONS WILL ADD TO OR REVISE CERTAIN SECTIONS OF THE “CITY OF CHEYENNE/BOARD OF PUBLIC UTILITIES CONSTRUCTION SPECIFICATIONS AND STANDARD DRAWINGS, 2014”. REVISED PARAGRAPHS AND ADDITIONS WILL CORRESPOND TO THE STANDARD NUMERICAL AND TITLE DESIGNATIONS.

THE SPECIAL PROVISIONS MAY ALSO INCLUDE NEW SECTIONS OF SPECIFICATIONS NOT COVERED IN THE STANDARD SPECIFICATIONS AND WILL BE NUMBERED STARTING FROM SECTION 04000.
BID SCHEDULE CLARIFICATION

1. Bidders are instructed that they are not required to submit pricing for each bid schedule (Earthworks Project, Geosynthetics Installation, Geosynthetics Procurement). The project will be awarded in the best interest of the City of Cheyenne (i.e. One or Multiple Contracts may be awarded).
CITY OF CHEYENNE
HAPPY JACK LANDFILL
CHEYENNE, WYOMING
PHASE 2, CELLS 1 AND 2 CONSTRUCTION PLANS
AND PHASE 2, CELL 3 EXCAVATION PLAN

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<td>9</td>
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<td>LEACHATE COLLECTION SYSTEM DILLE, DISCHARGE PIPE SYSTEM SECTIONS AND DETAILS</td>
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<td>12</td>
<td>TYPICAL FENCE AND MAN GATE DETAILS</td>
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ISSUED FOR BID
1. THE WORK FOR THIS PROJECT INCLUDES EXCAVATION OF CELLS 1, 2 AND 3 AND LINER CONSTRUCTION IN CELLS 1 AND 2.

2. COORDINATES, BEARINGS, AND DISTANCES ARE BASED ON WYOMING STATE PLANE COORDINATE SYSTEM, NAD83, EAST ZONE, U.S. SURVEY FEET.

3. VERTICAL DATUM IS NAVD88, GEOID09, U.S. SURVEY FEET.

4. CONTRACTOR IS RESPONSIBLE FOR PROTECTION OF ALL EXISTING STRUCTURES AND UTILITIES. CONTRACTOR SHALL LOCATE UTILITIES PRIOR TO CONSTRUCTION ACTIVITIES.

REFERENCES

1. EXISTING GROUND TOPOGRAPHY DEVELOPED FROM LASER SURVEY CONDUCTED BY WILSON RESEARCH AND DEVELOPMENT IN APRIL 2013 AND 2017.

2. COORDINATES, BEARINGS, AND DISTANCES ARE BASED ON WYOMING STATE PLANE COORDINATE SYSTEM, NAD83, EAST ZONE, U.S. SURVEY FEET.

3. VERTICAL DATUM IS NAVD88, GEOID09, U.S. SURVEY FEET.
1. EXISTING GROUND TOPOGRAPHY DEVELOPED FROM LIDAR SURVEY CONDUCTED BY WESTERN RESEARCH AND DEVELOPMENT IN APRIL 2013 AND 2007.

2. COORDINATES, BEARINGS, AND DISTANCES ARE BASED ON WYOMING STATE PLANE COORDINATE SYSTEM, NAD83, EAST ZONE, U.S. SURVEY FEET.

3. VERTICAL DATUM IS NAVD88, GEOID09, U.S. SURVEY FEET.

REFERENCES

1. EXISTING GROUND TOPOGRAPHY DEVELOPED FROM LOAD SURVEY CONDUCTED BY WESTERN RESEARCH AND DEVELOPMENT IN APRIL 2013 AND 2007.

2. COORDINATES, BEARINGS, AND DISTANCES ARE BASED ON WYOMING STATE PLANE COORDINATE SYSTEM, NAD83, EAST ZONE, U.S. SURVEY FEET.

3. VERTICAL DATUM IS NAVD88, GEOID09, U.S. SURVEY FEET.

NOTE(S)

1. CELL 3 TO BE EXCAVATED TO GRADE UNDER THIS CONTRACT. LINER CONSTRUCTION IN CELL 3 IS NOT PART OF THIS CONTRACT.

2. ALL CUT SLOPES NOT RECEIVING LINER AND SOIL STOCKPLIES SHALL BE STABILIZED THROUGH SEEDING AND MULCHING.

3. BARBED WIRE ON FENCE SHALL BE TOWARDS LANDFILL.

4. EXCAVATION SOILS SHALL BE USED AS STRUCTURAL FILL OR STOCKPILED AT LOCATIONS SHOWN ON SHEET 2. STOCKPILE SIDESLOPES SHALL NOT EXCEED 4H:1V.

ISSUED FOR BID
NOTES
1. ALL MATERIALS SHALL BE AS SPECIFIED OR ENGINEER APPROVED EQUIVALENT.
2. CONTRACTOR SHALL PROVIDE 316 STAINLESS STEEL CAM COUPLERS FOR DISCHARGE HOSE SEGMENT CONNECTIONS.
3. FREEZE PROTECTION IS REQUIRED FOR ABOVE GROUND PIPING. ELECTRIC HEAT TRACE, INSULATION AND CLADDING AS REQUIRED.
4. ALL PIPING OUTSIDE OR BELOW THE CONCRETE CONTAINMENT SHALL BE DUAL WALL SECONDARY CONTAINMENT PIPE 4" x 2".

2" HDPE FLANGE ADAPTER
2" X 2" HDPE 2 PIECE FLANGE
2" VAN STONE PVC 2 PIECE FLANGE
2" VAN STONE PVC 2 PIECE FLANGE ADAPTER
2" X 2" VAN STONE PVC 2 PIECE FLANGE
2" X 2" VAN STONE PVC 2 PIECE FLANGE ADAPTER
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<td>01 40 00 Quality Assurance and Quality Control Requirements</td>
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33 01 12.13 Electrical Continuity Testing
33 46 16 Subdrainage Pipe

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SECTION 00 01 15
LIST OF DRAWINGS

PART 1 – GENERAL

1.1 DESCRIPTION

A. This Section lists the Drawings for the Happy Jack Landfill Phase 2, Cells 1 and 2 Construction and Cell 3 Excavation Earthworks Project.

1.2 CONTRACT DRAWINGS

A. The Contract Drawings are as follows:
1. Sheet 1 – Cover Sheet
2. Sheet 2 – Existing Conditions
3. Sheet 3 – Subgrade Plan
4. Sheet 4 – Liner and Leachate Collection System Plan
5. Sheet 5 – Leachate Force Main Plan and Profile (Sheet 1 of 2)
6. Sheet 6 – Leachate Force Main Plan and Profile (Sheet 2 of 2)
7. Sheet 7 – Liner Details
8. Sheet 8 – Leachate Collection System Details (Sheet 1 of 2)
9. Sheet 9 – Leachate Collection System Details (Sheet 2 of 2)
10. Sheet 10 – Leachate Collection System P&ID
11. Sheet 11 – Leachate Collection System Cell Discharge Pipe System Sections and Details
12. Sheet 12 – Fence Details

1.3 PROJECT CONDITIONS

A. CONTRACTOR shall inform OWNER of any discrepancies, errors, or omissions discovered or in the Bidding Documents.

B. Where there are differences, as determined by the OWNER, between details and dimensions shown on the Contract Drawings and details and dimensions of existing features at the Site, CONTRACTOR shall use details and dimensions of existing features at the Site.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

***END OF SECTION***
### BASE BID UNIT PRICE SCHEDULE

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**TOTAL BASE BID:** $ 

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### BID ALTERNATE UNIT PRICE SCHEDULE

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PART 1 – GENERAL

1.1 SUMMARY

A. The Work specified in this Contract consists of furnishing all management, supervision, labor, materials, tools, equipment, services, testing and incidentals for the completion of the Work as indicated in the Contract Documents.

B. The information presented in the Bidding Documents illustrates the best information available. Existing field conditions shall be field verified prior to performance of the Work.

1.2 PROJECT INFORMATION

A. Project Name: Happy Jack Landfill, Phase 2 Cells 1 And 2 Construction and Cell 3 Excavation, Earthworks Project.

B. ENGINEER's Project No.: 123-81971

C. Project Site (the Site): Happy Jack Landfill
   1461 Happy Jack Rd
   Cheyenne, WY 82009

D. OWNER: City of Cheyenne

E. ENGINEER: Golder Associates Inc.

F. OWNER's REPRESENTATIVE: Solid Waste Professionals of Wyoming, LLC

G. CQA FIRM/MANAGER: Solid Waste Professionals of Wyoming, LLC

H. Contracting Method: The OWNER will contract the Work through the following three independently awarded Contracts:
   1. Earthworks
   2. Geosynthetic Procurement
   3. Geosynthetic Installer

   It shall be the responsibility of each Contractor to coordinate with the OWNER, the CQA MANAGER, and the other Contractors to ensure that the Work is scheduled and completed within the Contract Time(s).

   The GEOSYNTHETICS INSTALLER contract will not be executed until FY2022, which commences on July 1, 2021. It is the requirement of this Earthworks Contract that all excavation and grading work necessary for geosynthetic installation be completed by July 1, 2021. If those earthworks are completed prior to that date, CONTRACTOR will be required to re-mobilize to complete the earthworks components of this Work associated with geosynthetic installation and any/all other
components of the Work. No separate or additional payments will be made to CONTRACTOR for additional mobilization/demobilizations.

I. Bidding: The Bid includes a Base Bid and a Bid Alternate. OWNER reserves the right to award Contract on the basis of Base Bid or in consideration of the Bid Alternate.

1.3 DEFINITIONS

A. Wherever used throughout the Specifications, the terms listed below have the meanings indicated:
   1. CONTRACTOR – The individual or entity with whom the OWNER has entered into an Agreement for performance of the earthworks components of the Work.
   2. GEOSYNTHETICS MANUFACTURER – The individual or entity with whom the OWNER has entered into an agreement for the procurement of the geosynthetic materials, independent of the earthworks and geosynthetic installation contracts.
   3. GEOSYNTHETICS INSTALLER - The individual or entity with whom the OWNER has entered into an agreement for the installation of the geomembrane and GCL liners, independent of the earthworks and geosynthetic procurement contracts.
   4. OWNER’S REPRESENTATIVE - The individual or firm designated by the OWNER to assume all rights and authorities designated to the OWNER in connection with the completion of the Work.

1.4 DESCRIPTION OF WORK

A. The Work to be performed under this Earthworks Contract consists of excavating Cells 1, 2, and 3 to the lines and grades shown in the Contract Drawings and completing additional ancillary work for the construction of Cells 1 and 2 as described in the Contract Documents. This includes, but is not limited to, the following construction activities:
   1. Mobilization and demobilization of all equipment, material, and labor required to complete the Work;
   2. Preparation of a Storm Water Pollution Prevention Plan (SWPPP) and filing of a Notice of Intent (NOI) with the Wyoming Department of Environmental Quality (WDEQ);
   3. Preparation of a site-specific Health and Safety Plan;
   4. Coordination with OWNER and other Site contractors on work areas and construction sequencing;
   5. Excavation to the subgrade contours for Cells 1, 2, and 3 as shown in the Contract Drawings;
   6. Subgrade preparation and finish grading of subgrade in Cells 1 and 2 to allow for the placement of geosynthetic clay liner (GCL) and geomembrane liner by the GEOSYNTHETICS INSTALLER;
   7. Excavation and backfill of the landfill liner anchor trenches to allow liner installation by the GEOSYNTHETICS INSTALLER;
   8. Procurement, hauling, and placement of the sand drainage layer (bid alternate operations layer) over top of the landfill liner in Cells 1 and 2;
   9. Procurement of materials and construction of leachate collection and recovery system (LCRS) sumps, collection pipes, and riser pipe concrete
protection slab, including LCRS collection, cleanout, and riser pipes (6, 12 and 18-inch HDPE as specified in the Contract Drawings), drainage gravel, geotextile fabric, and concrete, and coordination with the GEOSYNTHETICS INSTALLER on timing and installation of the liner materials within LCRS sumps;

10. Construction of leachate force main pipeline and all associated appurtenances, including pipe fittings, stub outs, pumps, and instrumentation. Electrical service will be provided by the OWNER;

11. Construction of new chain-link fence;

12. Construction and seeding of stormwater channels, stockpiles, earthen berms, excavation sideslopes and other areas noted in the Contract Drawings, either through drill seeding or hydro-application; and

13. Preparation of project schedules, progress reports, and submittals.

It is not intended that this description of the Work encompass each particular item required, but rather that it give information concerning the general scope and areas of work for the convenience of the Bidders. Please see Section 01 22 13 Measurement and Payment for detailed descriptions of the Work and all unit price and lump sum pay items.

B. The Bid includes one bid alternate for the sand drainage layer as specified; see Section 31 23 00 for bid alternate requirements. OWNER will evaluate bid alternate price in consideration of the GEOSYNTHETICS INSTALLER bid alternate.

C. Sand drainage layer, gravel material, Class W road base, and Class B bedding material (and bid alternate operations layer material) shall be sourced and imported by the CONTRACTOR from an approved off-site source.

D. CONTRACTOR responsibilities as required by the Contract Documents include the following:

1. Be solely responsible for all means, methods, techniques, sequences, and procedures of construction, including any necessary construction staking and testing described in the Contract Documents.

2. Except as specifically noted, furnish all supervision, labor, materials, tools, supplies, machinery and equipment necessary for completion of the Work as described in the Contract Documents.

3. Obtain and pay for permit and licenses as necessary for proper performance and completion of the Work, as applicable at time of receipt of bid.

4. Comply with codes, ordinances, rules, regulations, orders and other legal requirements of public authorities that bear on performance of the Work.

5. Furnish a competent and adequate staff, as necessary for the proper administration, coordination, supervision, and superintendence of the Work; organize the procurement of all materials and equipment so that they will be available at the time they are needed for the Work; and keep an adequate force of skilled workmen on the job to complete the Work in the best and soundest manner in accordance with the requirements of the Contract Documents and in the most expeditious and economical manner consistent with the interests of the OWNER.

6. Furnish any and all health and safety related items required by Section 01 35 29 Health, Safety, and Emergency Response Procedures.

7. Coordinate with OWNER so as to minimize inconvenience and conflict with overall site operations and to facilitate on-going usage of Site by OWNER.
8. Attend regularly scheduled progress meetings at the Site in accordance with Section 01 31 13 Project Coordination.
9. Provide containment and disposal of all waste materials and remove all waste and debris from the project area and dispose of in a legal manner.
10. Provide any necessary transportation of all CONTRACTOR's construction personnel.
11. Provide portable toilet facilities for use by CONTRACTOR personnel in a location to be approved by the OWNER.
12. Notify the OWNER by the end of the workday of all accidents and submit a written report to the OWNER's representative giving full details and statements of witnesses, within 24 hours of the accident. In addition, if death, serious injuries or serious damages are caused, the accident shall be reported immediately by telephone or messenger to the OWNER.
13. Render all necessary assistance and equipment to the OWNER AND CQA MANAGER for inspection of the Work. The CONTRACTOR shall provide sufficient, safe and proper facilities at all times for the inspection of the Work by the OWNER and/or CQA MANAGER. The CONTRACTOR shall provide sufficient advance notice for the OWNER and/or CQA MANAGER to inspect any portion of the Work.
14. Remove any defective work found to exist, whether the result of poor workmanship, use of defective materials, or damage through the CONTRACTOR's carelessness, and immediately replace with work and materials which conform to the Contract Documents, or remedy in a manner authorized by the OWNER or OWNER'S REPRESENTATIVE at the CONTRACTOR's expense.
15. Provide all necessary electrical power and fuel for construction as necessary.
16. Provide written notification to the ENGINEER and OWNER's REPRESENTATIVE of all conflicts, errors or discrepancies that the CONTRACTOR discovers in the Contract Documents and the written response thereof by the ENGINEER and/or OWNER's REPRESENTATIVE is acceptable to the CONTRACTOR.
17. Submit a detailed schedule for construction within 10 days of Notice of Award to OWNER's REPRESENTATIVE.

1.5 OWNER RESPONSIBILITIES

A. OWNER will arrange for and deliver necessary electronic versions of Contract Drawings to CONTRACTOR for information and coordination of the Work and for installation.
B. OWNER will furnish the data required of OWNER under the Contract Documents.
C. OWNER will provide construction quality assurance (CQA) monitoring to observe and record construction.
D. The OWNER will not supervise, direct or have control or authority over, nor be responsible for, CONTRACTOR's means, methods, techniques, sequences, or procedures of construction or the safety precautions and programs incident thereto, or for any failure of CONTRACTOR to comply with Laws and Regulations applicable to the furnishing or performance of the work. OWNER will not be responsible for CONTRACTOR's failure to perform or furnish the Work in accordance with the Contract Documents.
E. OWNER will furnish water for construction from an on-site water source.
1.6 WORK BY OTHERS

A. The OWNER will procure the geosynthetic materials directly from the GEOSYNTHETICS MANUFACTURER. This will include the 60-mil HDPE geomembrane (double-sided textured), the GCL, and the 12 oz/sy and 16 oz/sy geotextile fabric (and bid alternate 200 mil geocomposite) for use in the Work. The CONTRACTOR shall be responsible for unloading the geosynthetic materials at the site and for storing and protecting the materials prior to installation, as described in the Contract Documents. The GEOSYNTHETICS INSTALLER will deploy and install the GCL and the geomembrane (and the bid alternate geocomposite). The CONTRACTOR shall be responsible for the installation of the geotextile as shown in the Contract Drawings.

The OWNER will provide above-ground electrical service to the leachate collection and recovery system (LCRS) cell discharge pipe system locations along the force main. CONTRACTOR shall be responsible for coordinating with OWNER on electrical installation requirements.

B. All other materials required to complete the Work, other than those specifically identified in Article 1.6A of this Section, shall be furnished by the CONTRACTOR.

1.7 SEQUENCE AND PROGRESS OF WORK

A. Requirements for sequencing or scheduling the Work are discussed in Section 01 31 13 Project Coordination.

1.8 CONTRACTOR’S USE OF SITE

A. The CONTRACTOR shall coordinate with the OWNER to establish haul routes, right of way, schedule, traffic control requirements, signage, etc.

B. CONTRACTOR shall not enter or disturb portions of the site beyond the areas in which the Work is located without OWNER’s approval.

PART 2 – PRODUCTS

A. The CONTRACTOR shall provide all labor, materials, tools, and equipment necessary for the completion of the Work as required by the Contract Documents.

PART 3 – EXECUTION

A. The CONTRACTOR shall comply with all local, state, and federal laws and regulations. OWNER will not be liable for any fines, penalties, etc.

***END OF SECTION***
SECTION 01 22 13
MEASUREMENT AND PAYMENT

PART 1 – GENERAL

1.1 DESCRIPTION

A. This Section describes the administrative and procedural requirements for how Lump Sum and Unit Price pay items will be measured and paid for when making progress and final payments.

B. Lump Sum and Unit Price pay items listed in this Section refer to and are the same pay items listed in the Bid Form and constitute all pay items for completing the Work in this Contract. Compensation for all services, items, materials, and equipment required to complete the Work shall be paid at the Lump Sums and Unit Prices included in the Contract.

C. All measurements and payments will be based on completed Work performed in strict accordance with the Contract Documents and in accordance with Contract Lump Sums and Unit Prices. Incidental Work and items not listed in the Contract Bid Form will not be paid separately but will be included in the payment for the listed item or items to which such incidental Work applies.

D. Lump Sums and Unit Prices shall include all direct and indirect costs, including CONTRACTOR's overhead and profit for each separately identified item.

E. The OWNER will provide the surveying required for the completion and measurement of the Work as specified in Section 01 71 23 Surveying.

1.2 ENGINEER’S ESTIMATE OF QUANTITIES

A. ENGINEER’s estimated quantities for Unit Price pay items, as listed in the Bid Form, are approximate only and are included solely for the purpose of comparison of Bids. OWNER does not expressly or by implication agree that the actual quantities of material encountered or required will correspond therewith and reserves the right to increase or decrease any quantity or to eliminate any quantity, as OWNER may deem necessary.

1.3 PAYMENT PROCEDURES

A. CONTRACTOR shall submit Applications for Payment in accordance with Contract requirements.

1.4 LUMP SUM BID ITEMS

A. Payment items for the Work of this Contract for which Contract Lump Sum payments will be made are listed in the Bid Form. All costs for items of Work which are not specifically mentioned to be included in a particular Lump Sum or Unit Price payment item shall be included in the listed Lump Sum item most closely associated with the Work involved. The Lump Sum price and payment made for each item listed shall constitute full compensation for furnishing all labor, materials, and equipment,
and performing any associated CONTRACTOR quality control, environmental protection, safety requirements, tests and reports, and for performing all Work required for which separate payment is not otherwise provided.

B. Contract Lump Sum is full compensation.

1.5 UNIT PRICE BID ITEMS

A. Payment items for the Work of this Contract on which the Contract Unit Price payments will be made are listed in the Bid Form. The Unit Price and payment made for each item listed shall constitute full compensation for furnishing all labor, materials, and equipment, and performing any associated CONTRACTOR quality control, environmental protection, survey control, safety requirements, tests, and reports, and for performing all Work required for each of the Unit Price items.

B. Contract Unit Price multiplied by agreed quantity is full compensation.

1.6 BASE BID ITEM DESCRIPTIONS

Item 1 – Mobilization/Demobilization
1. PAYMENT: Payment will be made for costs to mobilize and demobilize all labor, equipment, supplies, tools, field offices, parts, trailers, portable facilities, fuel tanks, sanitary facilities, and other incidents required to perform the Work, including but not limited to insurance and bonding, locating/verification of existing utilities, construction permits and fees, dust control, site administration expenses, utilities to the job trailer including power, internet/data services, telephone, etc., and site cleanup to the satisfaction of the OWNER.
2. UNIT OF MEASURE: Lump Sum. Payment shall be made at the Lump Sum price, not to exceed 10% of the total Bid Price, at the rate of 50% of the Lump Sum with the first invoice and 50% following Substantial Completion of the Contract.
3. MEASUREMENT: There shall be no measurement for payment.

Item 2 – Erosion and Sediment Control
1. PAYMENT: Full compensation for all labor, materials, equipment, and other incidental costs necessary to satisfactorily provide erosion and sedimentation control during the course of the Work. This shall include preparation of a Stormwater Pollution Prevention Plan (SWPPP) and filing a Notice of Intent (NOI) for an NPDES Stormwater Discharge Permit for Construction Activities with the WDEQ. This item shall also include the installation, maintenance, repair, replacement, and removal of temporary erosion control measures as specified in the SWPPP, periodic removal of collected sediment when directed by the CQA MANAGER, and site restoration after construction is complete (i.e., silt fence and hay bale removal, re-grading related to erosional soil loss, etc.).
2. UNIT OF MEASURE: Lump Sum. Payment shall be made at incremental percentages of the Lump Sum price as the Work progresses as agreed to between the CONTRACTOR and the OWNER’S REPRESENTATIVE.
3. MEASUREMENT: There shall be no measurement for payment.
Item 3 – Strip and Stockpile Topsoil
1. PAYMENT: Full compensation for all labor, materials, equipment, and other incidentals associated with stripping topsoil from within the Work area as required by the Contract Documents or as directed by the CQA MANAGER and stockpiling in the area shown in the Contract Drawings. This item shall also include clearing and grubbing of the Cell 1, 2 and 3 areas of grasses and forbs, as necessary, and removal of vegetative debris.
2. UNIT OF MEASURE: Cubic yardage of material stripped.
3. MEASUREMENT: The total quantity of stripped topsoil for which payment shall be made shall be computed by field survey or field measurement of stockpiled topsoil.

Item 4 – Excavation
1. PAYMENT: Full compensation for all labor, materials, equipment, and other incidental costs required to excavate Cells 1, 2 and 3 to the subgrade elevations shown in the Contract Drawings, inclusive of the perimeter road and stormwater channels, including load, haul, and placement of excavation spoils in appropriate OWNER-designated stockpile areas as shown in the Contract Drawings and/or as required or directed by the CQA MANAGER, maintaining safe excavation and fill slopes, development and maintenance of temporary haul roads, providing traffic control as necessary, and coordination with Site operations.
2. UNIT OF MEASURE: Cubic yardage of excavation, as computed in the ground prior to excavation.
3. MEASUREMENT: The total quantity of excavated material for which payment shall be made shall be computed by the difference in the pre-construction survey (to be provided by the OWNER) and the as-built survey and/or progress payment surveys performed within the construction limits.

Item 5 – Prepare Cell Subgrade (Finish Grading)
1. PAYMENT: Full compensation for all labor, materials, equipment, and other incidental costs required to prepare and finish grade the Cell 1 and 2 subgrade to within ±0.1 feet of the design subgrade elevations shown in the Contract Drawings; including protection and maintenance of the subgrade; drying and/or moisture-conditioning for roller compaction, as required; excavating, hauling, and satisfactorily disposing of and replacing all unsuitable subgrade material; and proof-rolling as directed by the CQA MANAGER.
2. UNIT OF MEASURE: Square yardage of subgrade prepared.
3. MEASUREMENT: The total quantity of subgrade for which payment shall be made shall be computed by the square yardage of subgrade prepared within the Cell 1 and 2 construction limits, as determined by the as-built survey and approved by the CQA MANAGER and GEOSYNTHETICS INSTALLER prior to geosynthetic liner installation.

Item 6 – Anchor Trench
1. PAYMENT: Full compensation for all labor, materials, equipment, and other incidental costs required to excavate and backfill the geosynthetic liner anchor trench; including coordination with the GEOSYNTHETICS INSTALLER on the timing and extent of excavation; excavation of the anchor trench; backfill of the trench with Structural Fill once the geosynthetics have
been placed within the trench by the GEOSYNTHETICS INSTALLER; any moisture-conditioning and compaction required for backfill placement; and excavating, hauling, and satisfactorily disposing of and replacing all unsuitable anchor trench materials.

2. UNIT OF MEASURE: Linear footage of anchor trench constructed.

3. MEASUREMENT: The total quantity of anchor trench for which payment shall be made shall be determined by field survey along the centerline of the excavated anchor trench.

Item 7 – Sand Drainage Layer

1. PAYMENT: Full compensation for all labor, materials, equipment, and other incidental costs associated with the procurement, testing, hauling, and placement of the sand drainage layer in Cells 1 and 2.

2. UNIT OF MEASURE: Cubic yardage of sand drainage layer placed measured in-place.

3. MEASUREMENT: The quantity of sand drainage layer for which payment shall be made shall be determined by field survey of the top of the placement area within Cells 1 and 2 and multiplying this area by the required 1-foot thickness.

Item 8 – Cell 2 Termination Berm

1. PAYMENT: Full compensation for all labor, materials, equipment, and other incidental costs required to construct the termination berm along the eastern side of Cell 2, as shown in the Contract Drawings; including hauling and placement of Structural Fill and furnishing and placing the plywood protection layer.

2. UNIT OF MEASURE: Linear footage of termination berm constructed.

3. MEASUREMENT: The total quantity of termination berm for which payment shall be made shall be determined by field survey along the centerline of the constructed termination berm.

Item 9 – Finish Grading of Perimeter Road and Stormwater Channels

1. PAYMENT: Full compensation for all labor, materials, equipment, and other incidental costs required to finish grade the perimeter road and stormwater channels to within ±0.1 feet of the design grades shown in the Contract Drawings, including survey control. The earthwork associated with the development of the perimeter road and stormwater channels will be paid under Bid Item 4.

2. UNIT OF MEASURE: Linear footage of channel finish graded.

3. MEASUREMENT: The total quantity of channel for which payment shall be made shall be determined by field survey along the centerline of the channels.

Item 10 – WYDOT Class W Road Base

1. PAYMENT: Full compensation for all labor, materials, equipment, and other incidentals associated the procurement, testing, hauling, placement, and compaction of Class W road base material along the perimeter road.

2. UNIT OF MEASURE: Cubic yardage of Class W road base.

3. MEASUREMENT: The total quantity of Class W road base material for which payment shall be made shall be computed by field survey of installation area times 0.5 foot in thickness.
Item 11 – Sump Construction
1. PAYMENT: Full compensation for all labor, materials, equipment, and other incidental costs associated with the construction of the leachate collection and recovery system (LCRS) sumps, (both primary and secondary) including coordination with the GEOSYNTHETICS INSTALLER on the timing of the earthwork construction and the geosynthetic installations; procurement, testing, hauling, and placing LCRS gravel in the primary sumps and secondary sumps; and installing geotextile fabric (to be provided by GEOSYNTHETICS MANUFACTURER at no cost to CONTRACTOR) as shown in the Contract Drawings. Pipe material and installation costs will be paid under Bid Items 12 and 14.
2. UNIT OF MEASURE: Each.
3. MEASUREMENT: There shall be no measurement for payment.

Item 12 – LCRS Collection Pipe
1. PAYMENT: Full compensation for all labor, materials, equipment, and other incidental costs associated with the procurement and installation of the 6-inch diameter HDPE SDR 17 perforated LCRS collection pipe and end caps; including procurement, testing, hauling, and placement of LCRS gravel around pipe, and installing geotextile fabric (to be provided by GEOSYNTHETICS MANUFACTURER at no cost to CONTRACTOR) around the LCRS pipe and gravel, as shown in the Contract Drawings.
2. UNIT OF MEASURE: Linear footage of LCRS collection pipe installed.
3. MEASUREMENT: The total quantity of LCRS collection pipe for which payment shall be made shall be determined by field survey along the pipe alignment from sump to pipe end (excluding riser pipe).

Item 13 – LCRS Leachate Collection Pumps
1. PAYMENT: Full compensation for all labor, materials, equipment, and other incidental costs associated with the procurement and installation of the leachate collection pumps; including all associated fittings and appurtenances, suspension cable, and clamps as specified in the Contract Drawings or as deemed necessary to complete the Work. Pipe hosing material and installation costs will be paid under Bid Item 16.
2. UNIT OF MEASURE: Each.
3. MEASUREMENT: There shall be no measurement for payment.

Item 14 – Sump Sideslope Riser Pipes
1. PAYMENT: Full compensation for all labor, materials, equipment, and other incidental costs associated with the procurement and installation of the 18-inch diameter SDR 17 HDPE pipe (solid and perforated, in primary LCRS sump), 12-inch diameter SDR 17 HDPE pipe (solid and perforated, in secondary LCRS sump) and 6-inch diameter SDR HDPE pipe (solid, for LCRS collection pipe cleanout riser) along the landfill cell sideslopes, as shown in the Contract Drawings; including excavating riser corridors; procurement, hauling, and installation of Class B Bedding material in the riser corridors; and installing geotextile fabric (to be provided by GEOSYNTHETICS MANUFACTURER at no cost to CONTRACTOR) around the riser corridors.
2. UNIT OF MEASURE: Linear footage of riser pipe corridor constructed.
3. MEASUREMENT: The total quantity of riser pipe corridor for which payment shall be made shall be determined by field survey along the corridor from pipe end to end (inclusive of the sump length).

Item 15 – Concrete Pipe Protection Slab
1. PAYMENT: Full compensation for all labor, materials, equipment, and other incidental costs associated with the construction of the concrete headwall at the crest of each riser pipe corridor; including the preparation of approved Structural Fill subgrade; furnishing and placing all formwork, rebar, and concrete as shown in the Contract Drawings, and furnishing and installing protective bollards.
2. UNIT OF MEASURE: Cubic yardage of concrete.
3. MEASUREMENT: The total quantity of concrete for which payment shall be made shall be computed by the cubic yardage of concrete installed, as measured by field measurement.

Item 16 – LCRS Discharge Pipe Systems
1. PAYMENT: Full compensation for all labor, materials, equipment, and other incidental costs associated with procurement and installation of the leachate sump distribution and discharge piping systems; including all piping and hoses from the LCRS leachate collection pumps to the pressurized leachate force main and including all associated fittings and appurtenances, flow control structures, valves, meters, couplings, electric heat trace, insulation, cladding, and pipe supports, as specified in the Contract Drawings or as deemed necessary to complete the Work.
2. UNIT OF MEASURE: Each. Payment shall be made at incremental percentages of the Lump Sum price as the Work progresses as approved by the OWNER’S REPRESENTATIVE.
3. MEASUREMENT: There shall be no measurement for payment.

Item 17 – Pressurized Leachate Force Main
1. PAYMENT: Full compensation for all labor, materials, equipment, and other incidental costs associated with the procurement and installation of the pressurized dual-containment leachate pipe; including trenching, removal of existing fencing around the leachate collection pond as necessary, procurement, hauling, and placement of Class B Bedding material in the trench, placement of drain pipe, electric heat trace, backfilling and compaction of trench, coordination with GEOSYNTHETICS INSTALLER on installation of pipe boot at existing leachate collection pond, fence restoration, and any other work deemed necessary to complete the Work as directed by the OWNER.
2. UNIT OF MEASURE: Linear footage of LCRS collection pipe installed.
3. MEASUREMENT: The total quantity of LCRS collection pipe for which payment shall be made shall be determined by field survey along the pipe alignment from end to end (excluding riser pipe and discharge system to force main).
Item 18 – Seeding
1. PAYMENT: Full compensation for all labor, materials, equipment, and other incidental costs associated with the seeding and mulching of areas to be re-vegetated as shown in the Contract Drawings, including providing and placing approved seed mix and mulch, furnishing and installing erosion control fabric as specified, and any other work deemed necessary to complete the Work as directed by the OWNER.
2. UNIT OF MEASURE: Acre of seeding, or part thereof.
3. MEASUREMENT: The total quantity of seeding for which payment shall be made shall be the acre, or part thereof, that has been seeded and mulched, as determined from field survey or field measurement.

Item 19 – Chain Link Fence
1. PAYMENT: Full compensation for all labor, materials, equipment, and other incidental costs associated with the installing chain-link fence as shown in the Contract Drawings.
2. UNIT OF MEASURE: Linear foot of fence installed.
3. MEASUREMENT: The total quantity of chain-link fence for which payment shall be made shall be determined by measurement along the top of the fence from center to center of end posts, excluding the length occupied by any gate openings.

1.7 BID ALTERNATE ITEM DESCRIPTIONS

Item 7A – Operations Layer
1. PAYMENT: Full compensation for all labor, materials, equipment, and other incidental costs associated with the procurement, testing, hauling, and placement of operations layer material in Cells 1 and 2.
2. UNIT OF MEASURE: Cubic yardage of operations layer material placed measured in-place.
3. MEASUREMENT: The quantity of operations layer for which payment shall be made shall be determined by field survey of the top of the placement area within Cells 1 and 2 and multiplying this area by the required 1-foot thickness.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

***END OF SECTION***
SECTION 01 31 13

PROJECT COORDINATION

PART 1 – GENERAL

1.1 DESCRIPTION

A. Section includes:
   1. Requirements for project coordination between Contractors, utilities, and Site operations
   2. Requirements for project meetings including, but not limited to, the following:
      a. Pre-construction meeting.
      b. Progress meetings.
      c. Specially called meetings throughout the progress of the Work.

1.2 RESPONSIBILITIES

A. CONTRACTOR shall be solely responsible for coordination of the Work with the OWNER, CQA MANAGER, GEOSYNTHETICS INSTALLER, all subcontractors, suppliers, testing agencies, and others with whom coordination is necessary to complete the Work within the Contract Time and in accordance with the Contract Documents.

B. CONTRACTOR shall cooperate fully with other Contractors, including the CQA MANAGER, GEOSYNTHETICS INSTALLER, and GEOSYNTHETICS MANUFACTURER.

C. Scheduling and administration of project meetings is the responsibility of the OWNER’S REPRESENTATIVE. The responsibilities include, but are not limited to the following:
   1. Prepare agendas.
   2. Distribute written notice and agendas of regular and specially called meetings (4) four days in advance of meeting date.
   3. Make physical arrangement for meetings.
   4. Preside at the meetings.
   5. Record minutes and include significant proceedings and decisions.
   6. Distribute copies of minutes within three days after each meeting:
      a. To all participants in meeting.
      b. To all parties affected by decisions made at the meeting.

D. Representatives of CONTRACTOR and subcontractors attending the meetings shall be qualified and authorized to act on behalf of the entity each represents.

1.3 COORDINATION WITH OWNER

A. CONTRACTOR shall construct all Work in accordance with the lines and grades shown in the Contract Drawings, and as designated by OWNER and CQA MANAGER.
B. CONTRACTOR shall maintain a full-time on-site Superintendent for the duration of the Work. The Superintendent shall be responsible for the supervision of and/or coordination of all CONTRACTOR employees any subcontractors employed. The Superintendent shall have sufficient qualifications, experience, and authority to act as a single point of contact for the on-site staff, and to make adjustments to the means and methods as needed and as requested by the OWNER and CQA MANAGER.

C. CONTRACTOR shall coordinate on-site staging areas, access, and temporary facilities with OWNER.

D. For additional information, contact Matt Theriault at the City of Cheyenne Landfill Manager at (307) 637-6279.

1.4 COORDINATION OF CONSTRUCTION

A. CONTRACTOR is responsible for coordinating Work by preparation of schedules and progress reports, coordination of Record Drawings, and other work as necessary.

B. CONTRACTOR shall coordinate with CQA MANAGER on survey requirements; see Section 01 71 23 Surveying.

C. Several components of the WORK will require coordination with the GEOSYNTHETICS INSTALLER. CONTRACTOR shall work with GEOSYNTHETICS INSTALLER to schedule the Work to produce orderly, continuous progress and avoid delays due to lack of materials, subcontractor schedules, lack of available manpower, etc.

D. CONTRACTOR shall coordinate with owner on electrical service installation to leachate collection and recovery system (LRCS) cell discharge pipe system locations along the force main.

E. CONTRACTOR is responsible for ensuring that installed Work is complete and satisfactory prior to enclosing or covering. CONTRACTOR shall call for required inspections in a timely manner and shall not cover Work that requires inspection.

1.5 PRE-CONSTRUCTION MEETING

A. Time: Schedule within seven (7) days before the date of commencement of the Work established in the Contract Documents.

B. Location: Project site office of OWNER, except as otherwise designated in the meeting notice.

C. Attendance:
   1. OWNER’s REPRESENTATIVE
   2. CONTRACTOR
   3. Subcontractors
   4. Site Operator
   5. Site contractors
D. Minimum agenda
1. Distribution and discussion of:
   a. Schedule of Values
   b. Work phasing schedule
   c. Project progress schedule
   d. CONTRACTOR’s Health and Safety Plan
2. Critical work sequencing.
3. Use of Premises:
   a. Access to project site.
   b. Office, work and storage areas.
5. Work coordination:
   a. Relation and coordination with existing site operations.
   b. Relation and coordination of subcontractors.
   c. Designation of responsible personnel.
6. Procedures and processing of:
   a. Field decisions.
   b. Proposal requests.
   c. Submittals.
   d. Change orders.
   e. Application of payment.
8. Procedures for maintaining record documents.
10. Temporary utilities.

1.6 PROGRESS MEETINGS

A. Time:
1. Schedule regular periodic meetings as required by OWNER, but not less
   than every seven days, except as otherwise required.
2. Hold specially called meetings as required by work operations, progress
   of the work or as required by OWNER.

B. Location: Project site office of the OWNER, except as otherwise designated in
   the meeting notice.

C. Attendance:
1. OWNER’s REPRESENTATIVE
2. CONTRACTOR
3. Subcontractors
4. Site contractors

D. Minimum agenda:
1. Review and acceptance of minutes of previous meeting.
2. Review of work progress since previous meeting.
4. Note field observations, problems and decisions.
5. Discuss any problems which may impede planned progress.
6. Develop corrective measures and procedures to regain projected
progress schedule.
7. Revisions to progress schedule as required.
8. Plan progress for periods after the initial work period.
9. Coordinate projected progress with separate contractors as needed.
10. Review submittals schedules and expedite as required to maintain project progress schedule.
12. Review proposed changes for:
   a. Effect on progress schedule.
   b. Effect on completion date.
   c. Effect on separate contracts of Project.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 COORDINATION WITH PUBLIC AND PRIVATE UTILITIES

A. CONTRACTOR is responsible for locating and protecting existing underground improvements. Contact all utility companies for location of their facilities. To contact all utility companies for locates, call (800) 849-2476 and 811, at least 48 hours prior to excavation.

B. CONTRACTOR shall have personnel available to maintain the Work, as required, 24 hours per day every day. CONTRACTOR is responsible for housekeeping, dust and erosion control, and shall provide all equipment and personnel necessary to meet the requirements of this responsibility. CONTRACTOR shall provide OWNER and CQA MANAGER with the name(s) and telephone number(s) of the person(s) designated to be available for after-hours contact. If this person cannot be contacted, OWNER may use its equipment to correct problems. In this case, CONTRACTOR shall pay all costs incurred by OWNER.

C. CONTRACTOR shall not utilize private property for any purpose without written permission from the property owner.

3.2 TRAFFIC CONTROL

A. CONTRACTOR shall coordinate all traffic control with CQA MANAGER, and if directed, with the OWNER. Traffic control is required to comply with current Manual of Uniform Traffic Control Devices (MUTCD) as applicable.

B. CONTRACTOR to provide necessary signage to adequately protect public from the construction and direct them around the facility during normal hours of operation.

C. Prior to implementing any phase of the project that will require traffic control, CONTRACTOR will submit the plan to the CQA MANAGER for approval.

***END OF SECTION***
SECTION 01 35 29

HEALTH, SAFETY, AND EMERGENCY RESPONSE PROCEDURES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Section includes: Requirements for CONTRACTOR’s Health and Safety Plan (HASP).

B. The CONTRACTOR shall, for the purposes of the Occupational Health and Safety Act and for the duration of the Work of this Contract, be the “prime contractor” for the “work site” and do everything that is reasonably practicable to establish and maintain a system or process that will ensure compliance with the Act and its regulations, as required to ensure the health and safety of all persons at the “work site.”

1.2 REFERENCES

A. Regulatory Requirements: Laws and Regulations applying to the Work under this Section include, but are not limited to:

1. 29 CFR Part 1904 (OSHA), Recording and Reporting Occupational Injuries and Illnesses.
2. 29 CFR 1910 (OSHA), Occupational Safety and Health Standards.
3. 29 CFR 1926 (OSHA), Safety and Health Regulations for Construction.
4. 49 CFR 171.8, Transportation, Definitions and Abbreviations.
5. 49 CFR 258, Criteria for Municipal Solid Waste Landfills
7. Wyoming Occupational Safety and Health Administration (Wyoming OSHA) regulations

1.3 SUBMITTALS

A. CONTRACTOR shall submit HASP to the OWNER’S REPRESENTATIVE prior to pre-construction conference.

1. OWNER’S REPRESENTATIVE’s review and acceptance of HASP will be only to determine if the topics covered in HASP comply with the Contract Documents.
2. OWNER’S REPRESENTATIVE’s review and acceptance will not extend to safety measures, means, methods, techniques, procedures of construction, or whether representations made in the HASP comply with Laws and Regulations, or standards of good practice.

B. WORK at the Site will be prohibited until the written HASP has been accepted by OWNER’s REPRESENTATIVE.

C. Notwithstanding other provisions of the Contract Documents, changes in the Contract Price or Contract Times will not be authorized due to delay by
1.4 CONTRACTOR’S HEALTH AND SAFETY PROGRAM

A. CONTRACTOR shall prepare and maintain a written, Site-specific, Health and Safety Plan (HASP), and conduct all construction activities in a safe manner that avoids:
   1. Injuries to employees, subcontractors, and other persons with an interest at or near the Site;
   2. Significant increases in concentrations of contaminants in soil, water, or sediment near the Site; or
   3. Violations of OSHA, or other Laws or Regulations.

B. The HASP shall be prepared submitted by the CONTRACTOR and approved by the OWNER. The HASP will be kept at the Site, and shall address safety and health hazards of each phase of Work at the Site and shall include requirements and procedures for employee protection. The HASP shall address and include the following:
   1. CONTRACTOR’s organizational structure.
   2. Comprehensive work plan.
   3. Safety and health risk or hazard analysis for each task and operation found in the work plan.
   4. Contingency planning for handling and management of regulated waste types.
   5. Employee training assignments including copies of OSHA 24-hour supervised field activities and eight-hour refresher training certificates for each CONTRACTOR and subcontractor.
   6. Personal protective equipment (PPE) to be used by employees for each task and operation being conducted and decontamination procedures.
   7. Medical Surveillance Requirements: Medical clearance certificates for all CONTRACTOR and subcontractor employees assigned to the Project.
   8. Frequency and types of air monitoring, personnel monitoring, and environmental sampling techniques and instrumentation to be used, including methods of maintenance and calibration of monitoring and sampling equipment.
   9. Site control measures, including:
      a. Preventing trespassing;
      b. Preventing unqualified or unprotected workers from entering restricted areas by development of safe work zones and site controls;
      c. Preventing “tracking” of contaminants out of the Site;
      d. Maintaining log of employees at the Site and visitors to the Site;
      e. Communicating routes of escape and gathering points.
      f. Air emissions controls (for each type of waste that may be encountered).
   10. Response plan for safe and effective responses to special waste and hazardous waste including necessary PPE and other equipment.
   11. Handling and sampling of intact drums.
B. Organizational Structure:
1. Organizational structure portion of the HASP shall refer to or incorporate information on specific chain of command and specify the overall responsibilities of supervisors and employees, and shall include the following:
   a. Designation of general supervisor who has responsibility and authority to direct all operations.
   b. Name of Site safety representative who has responsibility and authority to implement and modify the HASP and verify compliance.
   c. Other personnel required for operations at the Site and emergency response, and general functions and responsibilities of each.
   d. Lines of authority, responsibility, and communication.
2. Review and update organizational structure as necessary to reflect current status of Site operations and personnel.

1.5 ACCIDENT REPORTING AND INVESTIGATION

A. Comply with 29 CFR 1904.29, including using OSHA 300, 300-A, and 301 forms (or equivalent) to document all accidents that result in bodily injury.

B. Submit copies of completed accident reports to OWNER's REPRESENTATIVE.

C. Based upon results of accident investigation, modify the HASP as required by changing tasks or procedures to prevent reoccurrence of accident.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

***END OF SECTION***
SECTION 01 35 43
ENVIRONMENTAL PROCEDURES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Section includes: Requirements for environmental mitigation procedures including preparation of Stormwater Pollution Prevention Plan (SWPPP) and dust control

1.2 APPLICABLE REGULATIONS

A. CONTRACTOR shall comply with all applicable Federal, State, and local laws and regulations concerning environmental pollution control.

1.3 SUBMITTALS

A. The CONTRACTOR shall submit three copies of the SWPPP to the OWNER’S REPRESENTATIVE at least seven working days prior to the scheduled start of construction activities.

1.4 ENVIRONMENTAL REQUIREMENTS

A. The CONTRACTOR shall prepare and submit a Stormwater Pollution Prevention Plan (SWPPP) to the OWNER’S REPRESENTATIVE. The Plan shall outline the methods to be used by the CONTRACTOR to schedule and control all Work in a manner that will minimize the erosion of soils in the area of the Work. The SWPPP must describe and show how the CONTRACTOR will provide erosion control measures such as silt fence, staked hay bales, temporary diversion channels, sedimentation controls, berms, seeding, mulching or other special surface treatments as are required to prevent siltation of permanent diversion channels excess erosion of disturbed surfaces prior to and after establishment of re-vegetation. Erosion control measures shall be installed prior to commencement of construction activities, or as necessary as the Work progresses, and shall be maintained throughout the construction period or as dictated by the OWNER’S REPRESENTATIVE. All erosion control measures shall be in place in an area prior to any construction activity in that area.

1. CONTRACTOR must file Notice of Intent (NOI) to request discharge authorization for stormwater from large construction activities (General Permit WRY10-0000) and include a copy of the NOI in the SWPPP.

2. All phases of sedimentation and erosion control shall comply with and may be subject to the approval of the Wyoming Department of Environmental Quality (WDEQ). CONTRACTOR shall prepare a SWPPP sedimentation and erosion control drawing (and include within the SWPPP) meeting the requirements for approval by that agency.

1.5 DUST CONTROL

A. CONTRACTOR shall perform dust control operations, in an approved manner, whenever necessary or when directed by the OWNER’S REPRESENTATIVE, even
though other Work on the Project may be suspended. Dust control shall be generally accomplished by the use of water; however, the use of calcium chloride may be used when necessary, as approved by the OWNER’s REPRESENTATIVE, to control dust nuisance. CONTRACTOR shall use suitable means for obtaining and dispersing water for dust control activities.

B. No direct or separate payment will be made for dust control throughout the duration of the Work. Compensation for dust control shall be considered incidental to the Work and shall be included in the CONTRACTOR’s mobilization lump sum and/or unit prices included in the Contract.

1.6 NOTIFICATION

A. The OWNER will notify the CONTRACTOR in writing of any non-compliance with the foregoing provisions or of any environmentally objectionable acts and corrective action to be taken. If applicable, State or local agencies responsible for verification of certain aspects of the environmental protection requirements shall notify the CONTRACTOR in writing of any non-compliance with State or local requirements. The CONTRACTOR shall, after receipt of such notice, immediately take corrective action. Such notice, when delivered to the CONTRACTOR or his/her 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.

B. CONTRACTOR must file Notice of Intent (NOI) to request discharge authorization for stormwater from large construction activities (General Permit WRY10-0000) and include a copy of the NOI in the CONTRACTOR’s SWPPP.

1.7 IMPLEMENTATION

A. Prior to commencement of the Work, CONTRACTOR shall meet with the OWNER’S REPRESENTATIVE to develop mutual understandings relative to compliance with this provision and administration of the environmental pollution control program.

B. CONTRACTOR shall remove temporary environmental control features, when approved by the OWNER’S REPRESENTATIVE, and incorporate permanent control features into the project at the earliest practicable time.

PART 2 – PRODUCTS

2.1 DUST CONTROL

A. Dust control shall generally be accomplished by the use of water.

B. Water will be provided by OWNER on-site for dust control purposes.
PART 3 – EXECUTION

3.1 EROSION CONTROL

A. CONTRACTOR shall provide positive means of erosion control such as shallow ditches and berms around construction to carry off surface water. Erosion control measures, such as siltation basins, hay/straw check dams, mulching, jute netting, silt fences, and other equivalent techniques, shall be used as appropriate. CONTRACTOR shall use reasonable care to divert surface water run-on around construction areas. Flow of surface water into excavated and graded areas shall be prevented to the extent practicable.

3.2 PROTECTION OF LAND RESOURCES

A. Land resources within the Project boundaries and outside the limits of permanent Work shall be restored to a condition, after completion of construction that will appear to be natural and not detract from the appearance of the Project. Confine all construction activities to areas shown in the Contract Drawings.

B. Outside of areas requiring earthwork, the CONTRACTOR shall limit the amount of disturbance of surrounding brush and grass.

C. If the CONTRACTOR proposes to construct temporary roads or embankments and excavations for Work areas, he/she shall submit the following items for approval by the OWNER’S REPRESENTATIVE at least 5 days prior to scheduled start of such temporary work:
   1. A layout of all temporary roads, excavations, and embankments to be constructed within the Work area and a plan for restoring these areas.
   2. Details of temporary road construction.
   3. A drawing shall be submitted to indicate location of barriers required to control vehicular traffic passing close to road edges to be maintained undamaged. The drawing shall provide for the obliteration of construction scars as such and shall provide for a natural-appearing final condition of the area. Modification of the CONTRACTOR’s approved drawing shall be made only with the written approval of the OWNER’s REPRESENTATIVE. No unauthorized road construction, excavation or embankment construction including disposal areas will be permitted.

D. Remove all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess of waste materials, or any other vestiges of construction at the completion of the Work and as directed by the OWNER’S REPRESENTATIVE.

3.3 PROTECTION OF AIR QUALITY

A. The use of burning at the project site for the disposal of refuse and debris will not be permitted.

B. Dust Control:
   1. CONTRACTOR shall be responsible for controlling objectionable dust emanating from all excavations, grading, embankment, stockpiles, access roads, borrow areas and all other work areas within or without (where applicable
to CONTRACTOR’s work) the project boundaries so that is does not cause the standards for air pollution to be exceeded nor cause a hazard or nuisance to others.

2. CONTRACTOR shall perform dust control operations whenever necessary or when directed by the OWNER or OWNER’s REPRESENTATIVE, even though other work on the project may be suspended.

3. Methods of controlling dust shall meet all air pollutant standards as set forth by Federal and State regulatory agencies.

4. An approved method of stabilization consisting of sprinkling or other similar methods will be permitted to control dust. The use of petroleum products is prohibited.

5. Sprinkling, to be approved and effective, must be repeated at such intervals as to keep all parts of the disturbed area and all unpaved haul roads in such a condition to minimize nuisance dust emissions, and the CONTRACTOR must have sufficient competent equipment on the job to accomplish this if sprinkling is used. Dust control shall be performed as the Work proceeds and whenever a dust nuisance or hazard occurs, as determined by the OWNER’s REPRESENTATIVE.

3.4 MAINTENANCE OF POLLUTION CONTROL FACILITIES DURING CONSTRUCTION

A. CONTRACTOR shall perform Site inspections and assessments as required in applicable stormwater permits and this Section. Inspections and assessments shall be done by CONTRACTOR’s site superintendent or project manager, together with OWNER’S REPRESENTATIVE.

B. Inspections:
   1. During the Work, Site inspections shall be performed:
      a. After SWPPP controls are provided and prior to starting other Work at the Site.
      b. A minimum of every seven calendar days.
      c. Within 24 hours of the end of a wet weather event with ½-inch or more of precipitation
      d. Prior to CONTRACTOR submitting the Notice of Termination.

   2. During each inspection, CONTRACTOR shall verify sediment control practices and record approximate degree of sediment accumulation as a percentage of acceptable sediment storage volume; inspect erosion and sediment control practices and record maintenance performed; observe and record deficiencies relative to implementation of the SWPPP.

C. CONTRACTOR shall cooperate with representatives of authority having jurisdiction during periodic visits to Site, and promptly provide information requested by authority having jurisdiction.

D. CONTRACTOR shall complete repairs to SWPPP controls per applicable requirements and to satisfaction of OWNER’S REPRESENTATIVE within two calendar days of each inspection.

3.5 NOISE CONTROL

A. CONTRACTOR shall make every effort to minimize noises caused by his/her operations. Equipment shall be equipped with silencers or mufflers designed to
operate with the least possible noise in compliance with State and Federal regulations.

3.6 FIRE PRECAUTIONS

A. Smoking and Lunch Fires:
   1. Smoking is prohibited except inside a vehicle located away from the active site and existing operations, or other area specifically approved by the OWNER'S REPRESENTATIVE.
   2. The building of camp, lunch, warming, and other fires within the construction area and vicinity is prohibited.

B. Spark Arrester and Mufflers:
   1. Operating or using any internal combustion engine, on any timber, brush, or grass-covered land, including trails and roads traversing such land, without a spark arrester, maintained in effective working order, meeting either (I) Department of Agriculture, Forest Service standard 5100, “SPARK ARRESTERS FOR INTERNAL COMBUSTION ENGINES,” (current edition); or (II) the Society of Automotive Owner's Representatives (SAE) recommended Practices J335, "MULTIPOSITION SMALL ENGINE EXHAUST SYSTEM FIRE IGNITION SUPPRESSION," (current revision) and J350, 36 CFR 261.52(j), is prohibited.
   2. Passenger-carrying vehicles, pickups, medium and large highway trucks (80,000 GVW) must be equipped with a factory-designed muffler system that is specified for the make and model of the respective vehicle/truck or with a muffler system that is equivalent or that exceeds factory specifications.
   3. Exhaust systems shall be properly installed and continually maintained in serviceable condition.

C. Fire Extinguishers and Tools on Equipment:
   1. While in use, each internal combustion engine, including tractors, trucks, yarders, loaders, welders, generators, stationary engines, or comparable powered equipment shall be provided with at least the following:
      a. One fire extinguisher, at least 5#ABC with an Underwriters Laboratory (UL) rating of 4A - 40 BC, or greater.
      b. One shovel, sharp, size O or larger, round-pointed with an overall length of at least 48 inches.
      c. One ax, sharp, double bit 3-1/2#, or one sharp pulaski.
   2. Extinguishers, shovels, axes, and pulaskis shall be mounted so as to be readily available from the ground. All tools shall be maintained in a serviceable condition.

***END OF SECTION***
PART 1 – GENERAL

1.1 DESCRIPTION

A. Section includes: administrative and procedural requirements for quality assurance (QA) and quality control (QC).

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve CONTRACTOR of responsibility for compliance with the Contract Document requirements.

1.2 DEFINITIONS

A. Construction Quality Control (CQC): A planned system of inspections that is used to directly monitor and control the quality of a construction project. CQC is normally performed by the material/equipment installer or for natural soil materials by the CONTRACTOR, and is necessary to achieve quality in the constructed or installed system. CQC refers to measures taken by the Installer or CONTRACTOR to determine compliance with the requirements for materials and workmanship as stated in the Contract Documents.

B. Construction Quality Assurance (CQA): A planned system of activities that provides the OWNER assurance that the facility was constructed as specified in the design. CQA includes inspection, verifications, audits, and evaluations of materials and workmanship necessary to determine and document the quality of the constructed facility.

1.3 RESPONSIBILITIES

A. The CQA MANAGER will be responsible for all Quality Assurance testing as outlined in this Specification and the Construction Quality Assurance (CQA) Manual, unless otherwise noted.

B. The CONTRACTOR shall maintain an effective Construction Quality Control program. The system shall encompass all action involving selection of construction material sources and on-site and off-site production of construction materials, WORK placement procedures, workmanship, and as required, monitoring and testing.

1.4 TESTING AND FREQUENCY

A. Quality Control/Quality Assurance tests and frequency are discussed throughout the Specifications and in the CQA Manual. The frequencies indicated are minimums only, and do not include re-testing of failed materials. Those Quality Control/Quality Assurance tests and testing frequencies to be conducted in the field by the CQA MANAGER are presented in the CQA Manual.
1.5 QUALITY OF MATERIALS AND LABOR

A. All materials used on this Contract shall be new and the best market quality, unless specified or shown otherwise. All labor on this contract shall be competent and skilled for the Work. All Work executed under this contract shall be done in the best, most thorough, substantial and workmanlike manner. All material and labor shall be subject to the approval of the CQA MANAGER as to quality and compliance with the design and the Contract Documents and shall be removed if it does not meet with these requirements. The OWNER or CQA MANAGER may refuse to issue any certificate or payment until all defective materials or Work have been removed, and other material of proper quality substituted therefore. The cost associated with wasted or improperly installed materials that are placed by reasons of the failure of the CONTRACTOR to conform to the provisions of the Contract will not be paid for. This includes, but is not restricted to, additional quantities of materials, delays, Work, loading, hauling or disposal of the rejected materials.

B. All off-site earth materials proposed for use in the project shall be reviewed for the content of asbestos and other potential hazards or contamination.

1.6 CONTRACTOR RESPONSIBILITIES

A. The CONTRACTOR is responsible for the quality of the Work of the Contract.

B. The CONTRACTOR shall make good all Work for which any test result indicates the Work does not conform to the requirements of the Contract.

C. The CONTRACTOR shall certify that all equipment used in the Work is in accordance with the provisions of the Contract. Certification does not relieve responsibility for providing satisfactory materials, equipment, and workmanship.

D. Any inspection and/or testing shall not relieve the CONTRACTOR from any responsibility for the quality of the Work.

E. The CONTRACTOR shall be aware of all testing activities as presented in the CQA Manual and shall account for those activities in the construction schedule.

F. The CONTRACTOR shall be responsible for cooperating with the CQA MANAGER during all testing activities. CONTRACTOR shall provide equipment and labor to assist the CQA MANAGER in sampling, if requested, and shall also provide access to all areas requiring testing activities.

G. No Work shall be covered before the CQA MANAGER has approved the Work. If any material is covered without the approval of the CQA MANAGER, the CONTRACTOR will be required to re-excavate to expose the covered materials. The cost of exposing those materials and then backfilling and re-compacting, or otherwise doing rework, will be at the CONTRACTOR’S expense, regardless of the condition of the materials under question.

H. Upon start of installation of granular drainage/operations layer, CONTRACTOR shall be responsible for protection and maintenance of the geomembrane.
PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

***END OF SECTION***
PART 1 – GENERAL

1.1 TEMPORARY OFFICES

A. Temporary offices shall be established at the Site where approved or directed by the OWNER, adequately furnished, and maintained in a clean, orderly condition by the CONTRACTOR. The CONTRACTOR or his authorized representative shall be present in the field office at all times while work is in progress. Instructions received there from the OWNER shall be considered as delivered to the CONTRACTOR.

1.2 TEMPORARY LIGHT AND POWER

A. CONTRACTOR shall furnish temporary light and power, required to adequately light all work areas and with sufficient power capacity to meet the reasonable needs of all subcontractors. Make all necessary arrangements with the local electric company for temporary electric service, and pay all expenses in connection therewith.

1.3 TEMPORARY HEAT

A. Provide all heat as may be necessary for thawing out and heating the ground or materials and for proper execution, protection and drying out the Work.

1.4 WEATHER PROTECTION

A. The CONTRACTOR shall install and maintain temporary heat and enclosures to provide adequate working areas for personnel during the months of November through March.

B. Temporary heating units shall have been tested and labeled by UL, FM or other recognized association related to the type of fuel being used.

1.5 TEMPORARY SANITARY FACILITIES

A. The CONTRACTOR shall provide self-contained, single-occupant toilet units of the chemical, aerated recirculation, or combustion type, properly vented and fully enclosed in a fiberglass or other approved non-absorbent shell.

1.6 FIRE EXTINGUISHERS

A. The CONTRACTOR shall provide portable UL-rated, Class A fire extinguishers for temporary offices and similar spaces. NFPA 10 and 241 will be complied with for classification, extinguishing agent and size required by location and class of fire exposure.
1.7 BARRIERS

A. Provide as required to prevent public entry to construction areas, to provide for OWNER’s use of site, and to protect existing facilities and adjacent properties from damage from construction operations.

B. Protect against vehicular traffic, stored materials, dumping, chemically injurious materials, and puddling or continuous running water.

1.8 REMOVAL

A. Remove temporary materials, equipment, services, and construction prior to Substantial Completion inspection.

B. Clean and repair damage caused by installation or use of temporary facilities. Grade site to original contours or as indicated on the Contract Drawings.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

***END OF SECTION***
SECTION 01 71 23
SURVEYING

PART 1 – GENERAL

1.1 SUMMARY

A. The CQA MANAGER will provide layout of work surveys and certification surveying services required for the work.
   1. Layout of work surveys will be provided over the course of four site mobilizations.
   2. Certification surveying will be provided over the course of six site mobilizations.
   3. As-built surveys will be provided over the course of two site mobilizations.

B. The CONTRACTOR shall supply all construction surveying services not provided by the CQA MANAGER for the Work.

C. The OWNER will provide the CONTRACTOR electronic versions and TIN surfaces from the Contract Drawings.

D. Any disputes that arise in the survey shall be brought to the attention of the OWNER’s REPRESENTATIVE immediately and will be resolved in a timely manner.

E. All surveys shall be conducted by a Wyoming Licensed Land Surveyor and sealed.

1.2 DATUM

A. The horizontal coordinate system is NAD83.

B. The vertical datum is NAVD29.

1.3 PRIMARY CONTROL

A. The OWNER has established primary control to be used for establishing work lines and grades. Primary control consists of benchmarks and horizontal control points in the Work vicinity as shown in the Contract Drawings.

B. CONTRACTOR shall preserve and maintain primary control points until otherwise authorized.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 LAYOUT OF WORK SURVEYS

A. The CQA MANAGER shall establish lines and grades for work layout as follows:
   1. Slope stake excavation limits prior to construction at 50’ intervals around the construction limits and outer extent of stockpiles.
2. Layout liner system limits, anchor trench, earthen berms, and stormwater channels.
3. Layout leachate collection system side slope riser pipes, leachate collection sump, force main, and utility trench corridors.

B. The CQA MANAGER will establish measurements required for work execution to the specified tolerances.

C. The CONTRACTOR shall provide stakes, markers, and other survey controls necessary to control, check, and guide construction to ensure all Work is constructed in a manner which meets the tolerances described in Part 3.4 of this Section.

D. The CONTRACTOR shall be responsible for coordinating verification or measurements for planning and executing their own Work and that of any of their Subcontractors.

3.2 QUANTITY SURVEYS

A. CONTRACTOR shall perform surveys and computations to determine quantities of work performed for progress payments. OWNER will provide a topographic survey of the Work area prior to CONTRACTOR commencing earthmoving activities.

B. CQA MANAGER shall perform surveys necessary for CQA MANAGER to determine final quantities of work in place.

3.3 AS-BUILT SURVEYS AND RECORD DRAWINGS

A. CQA MANAGER shall perform final as-built surveys necessary for CQA MANAGER to verify that Work was completed to the lines and grades shown in the Contract Drawings.

B. CONTRACTOR shall notify CQA MANAGER a minimum of three (3) days in advance of anticipated completion dates for Work that will require as-built record surveying, including certification surveys of the subgrade, operations/drainage layer, and leachate collection and recovery (LCRS) components of the liner system.

C. CONTRACTOR shall maintain a clean, undamaged set of black line prints of the Contract Drawings. The CONTRACTOR shall mark up the set to show the actual installation, where the installation varies substantially from the WORK as originally shown. The CONTRACTOR shall mark whichever drawing is most capable of showing conditions fully and accurately. The CONTRACTOR shall give particular attention to concealed elements that would be difficult to measure and record at a later date.

3.4 ACCURACY AND TOLERANCES

A. Degree of Accuracy
   1. The accuracy of surveys shall be appropriate to meet the tolerances specified herein and shall be approved by the CQA MANAGER.
   2. The tolerances for construction, unless otherwise approved by the CQA MANAGER, shall be as follows:
a. Slopes:
   i. Line: ± 0.2 feet
   ii. Grade: ± 0.1 feet
b. Floors:
   i. Line: ± 0.2 feet
   ii. Grade: ± 0.1 feet
c. Sand drainage layer (bid alternate operations layer) thickness
   i. Thickness: + 0.1 feet

3. Cross-Section points: Locate within 0.10 foot, horizontally and vertically.

B. A record survey will be conducted on areas deemed final by the CQA MANAGER and approved by the CQA MANAGER. The CQA MANAGER will notify the CONTRACTOR of compliance with design grades and tolerances.

C. Any areas out of tolerance will be repaired by the CONTRACTOR at no additional cost to the OWNER. Quantities for final payment will be based on this record survey and will be calculated by the and verified by the CQA MANAGER.

3.5 PRESERVATION OF CONTROL POINTS AND STAKES

A. Control points and stakes lost or damaged during construction, unless previously authorized, shall be reset at the CONTRACTOR’s expense.

***END OF SECTION***
SECTION 03 30 00
CONCRETE

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
1. The Work in this Section shall consist of provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install cast-in-place concrete, reinforcement, and related materials.
2. The Work includes:
   a. Providing concrete consisting of Portland cement, fine and coarse aggregates, water, and approved admixtures; combined, mixed, transported placed, finished, and cured.
   b. Procurement and placement of reinforcement.
   d. Forming or coring penetrations as required to accommodate leachate collection and recovery system (LCRS) pipes as shown in the Contract Drawings.
B. The CONTRACTOR shall test concrete materials. Failure to detect any defective Work or material shall not in any way prevent later rejection when such defect is discovered, nor shall it obligate the OWNER for final acceptance or relieve the Contractor of the responsibility to provide concrete meeting the requirements of these Specifications.

1.2 REFERENCES
A. American Concrete Institute, (ACI).
   1. ACI 224, Control of Cracking in Concrete Structures.
   2. ACI 301, Specifications for Structural Concrete.
   3. ACI 304, Guide for Measuring, Mixing, Transporting, and Placing Concrete.
   4. ACI 305, Hot Weather Concreting.
   5. ACI 306, Cold Weather Concreting.
   6. ACI 347, Guide to Formwork for Concrete.
   1. ASTM A82, Specification for Steel Wire, Plain, for Concrete Reinforcement.
   2. ASTM A1064, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
   3. ASTM C33, Specification for Concrete Aggregates.
   8. ASTM C172, Practice for Sampling Freshly Mixed Concrete.
   9. ASTM C231, Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
1.3 QUALITY ASSURANCE

A. Source Quality Control:
   1. Concrete Testing Service:
      a. CONTRACTOR shall employ, at their own expense, testing laboratories
         experienced in design and testing of concrete materials and mixes to perform
         material evaluation tests and to design concrete mixes.
      b. Materials and installed Work may require testing and retesting, as directed by
         CQA MANAGER, at any time during the progress of the WORK. Tests not
         specifically indicated to be done at OWNER'S expense, including the retesting
         of rejected materials and installed Work, shall be done at CONTRACTOR'S
         expense.
   2. Certificates, signed by concrete producer and CONTRACTOR, may be submitted in
      lieu of material testing when acceptable to CQA MANAGER, in writing.
   3. CQA MANAGER may perform field quality control sampling and testing during
      concrete placement, as follows:
      b. Slump: ASTM C143, one test for each load at point of discharge.
      c. Air Content: ASTM C231.
      d. Compressive Strength: ASTM C39, one set of compression strength
         specimens for each 50 cubic yards or fraction thereof of concrete placed in
         any one day.
         1) Test one specimen at seven days and two specimens at 28 days.
         2) When the total quantity of concrete is less than 50 cubic yards, the
            strength tests may be waived by CQA MANAGER following review and
            acceptance of submitted field experience indicating evidence of
            satisfactory strength.
         3) Slump and air content testing shall be conducted on each sample from
            which compressive strength specimens are taken.
   4. Report test results in writing to CQA MANAGER on same day tests are made.

1.4 SUBMITTALS

A. The CONTRACTOR shall provide product data to allow evaluation by the CQA
   MANAGER.

B. The CONTRACTOR’s mix design shall contain the following information:
   1. Slump on which the mix design is based.
   2. Total gallons of water per cubic yard.
   4. Specific gravity and gradation of each aggregate.
   5. Ratio of fine to total aggregates.
   6. Weight (surface dry) of each aggregate per cubic yard.
   7. Brand, type, ASTM designation, active chemical ingredients and quantity of each
      admixture.
   8. Compressive strength based on 28-day compression tests.
   10. Entrained air content.

C. Laboratory Test Reports: Submit copies of laboratory test reports for concrete cylinders,
    materials and mix design tests. CQA MANAGER’s review will be for general information
only. Production of concrete to comply with specified requirements is the responsibility of CONTRACTOR.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver concrete reinforcement materials to the site bundled, tagged and marked.

B. All materials used for concrete must be kept clean and free from all foreign matter during transportation and handling and kept separate until measured and placed in the mixer. Bins or platforms having hard clean surfaces shall be provided for storage. Suitable means shall be taken during hauling, piling, and handling to ensure that segregation of the coarse and fine aggregate particles does not occur and the grading is not affected.

C. Store concrete reinforcement materials to prevent damage and accumulation of foreign material including dirt and excessive rust. Store on framework or blocking such that no materials come in contact with ground. Space framework or blocking supports to prevent excessive deformation of stored materials.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Portland Cement: ASTM C150, Type II.

B. Aggregates: ASTM C33.
   1. Fine Aggregate: Clean, sharp, natural sand free from loam, clay, lumps or other deleterious substances. Dune sand, bank run sand, and manufactured sand are not acceptable.
   2. Coarse Aggregate: Clean, uncoated, processed aggregate containing no clay, mud, loam, or foreign matter, as follows:
      a. Crushed stone, processed from natural rock or stone.
      b. Washed gravel, either natural or crushed. Use of slag and pit or bank run gravel is not permitted.

C. Coarse Aggregate Size: ASTM C33, Nos. 57 or 67, unless permitted otherwise by CQA MANAGER.

D. Water: Clean, potable.

E. Formwork: CONTRACTOR to design and furnish suitable and adequate forms conforming to shapes, lines, elevations, and dimensions of concrete on drawings using ACI 347 as a guide.

F. Curing: ACI 308, “Recommended Practice for Curing Concrete.”

2.2 CONCRETE MIX

A. Mix Designs: Provide ready mixed concrete for all concrete required in the DRAWINGS. Batch, mix and transport ready mixed concrete in accordance with ASTM C94. Plant, equipment and facilities shall conform to “Check List for Certification of Ready Mixed Concrete Production Facilities” of the National Ready Mixed Concrete Association.
B. Cast-In-Place Concrete:
1. Concrete shall have a minimum 28-day compressive strength of 3,500 psi, unless otherwise approved.
2. The maximum aggregate size shall be 3/4 inches.
3. The concrete shall be composed of cement, fine aggregate, coarse aggregate and water.
4. The concrete shall be homogeneous, readily placeable and uniformly Workable and shall be proportioned in accordance with ACI 211.1.
5. Proportions shall be established on the basis of field experience with the materials to be employed.

C. Qualities Required:

<table>
<thead>
<tr>
<th>Item</th>
<th>Quality Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class</td>
<td>A</td>
</tr>
<tr>
<td>Type of Cement</td>
<td>II</td>
</tr>
<tr>
<td>Compressive Strength (f'c) @ 28 days</td>
<td>3,500 psi</td>
</tr>
<tr>
<td>Slump</td>
<td>Maximum 4 inches</td>
</tr>
<tr>
<td>Air Content</td>
<td>6.5 ± 1.5 percent by volume</td>
</tr>
</tbody>
</table>

D. Rate of Hardening: Concrete mix shall be adjusted to produce the required rate of hardening for varied climatic conditions.

2.3 FORM MATERIALS

A. Provide form materials with sufficient stability to withstand pressure of placed concrete without bow or deflection. CONTRACTOR shall be responsible for design of the formwork system to resist all applied loads including pressures from fluid concrete and construction loads.

B. Smooth Form Surfaces: Acceptable panel-type to provide continuous, straight, smooth, as-cast surfaces as required by ACI 301.

C. Provide 3/4-inch chamfer at all external corners.

D. Form Ties:
1. Provide factory-fabricated, removable or snapoff metal form ties, designed to prevent form deflection, and to prevent spalling of concrete surfaces upon removal. Materials used for tying forms will be subject to approval of CQA MANAGER.
2. Unless otherwise shown, provide ties so that portion remaining within concrete after removal of exterior parts is at least 1.5-inches from the outer concrete surface. Unless otherwise shown, provide form ties that will leave a uniform, circular hole no larger than 1-inch diameter in the concrete surface when removed.
2.4 REINFORCING MATERIALS

A. WWF: ASTM A1064.
B. Steel Wire: ASTM A82.
C. Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcement in place.

PART 3 - EXECUTION

3.1 INSPECTION

A. CONTRACTOR shall examine the subgrade and the conditions under which the Work is to be performed and notify CQA MANAGER, in writing, of unsatisfactory conditions. Do not proceed with the WORK until unsatisfactory conditions have been corrected in a manner acceptable to CQA MANAGER.

3.2 FORMWORK

A. Construct formwork in accordance with ACI 347 such that concrete members and structures are of correct size, shape, alignment, elevation and position.
B. Provide openings in formwork to accommodate the WORK of other trades. Accurately place and securely support items required to be built into formwork.
C. Clean and adjust forms prior to concrete placement. Apply form release agents or wet forms, as required. Retighten forms during and after concrete placement, if required, to eliminate cement paste leaks.
D. Removal of Formwork:
   1. Conform to the requirements of ACI 301 and ACI 347, except as otherwise specified.
   2. Formwork or shoring shall not be removed until supported concrete members have acquired a minimum of 90 percent of specified compressive strength. Results of suitable quality control tests of field cured specimens may be submitted to CQA MANAGER for review as evidence that concrete has attained sufficient strength for removal of supporting formwork and shoring prior to removal times indicated herein.
   3. Removal time for all formwork will be subject to approval of CQA MANAGER.
   4. Form tie holes shall be repaired following the requirements of ACI 301.

3.3 CONCRETE PLACEMENT

A. Job-Site Mixing: Use drum type batch machine mixer, mixing not less than 1-1/2 minutes for one cubic yard or smaller capacity. Increase mixing time a minimum of 15 seconds for each additional cubic yard or fraction thereof.
B. Ready-Mixed Concrete: Comply with the requirements of ASTM C94.
C. Concrete Placement:
1. Place concrete in a continuous operation within planned joints or sections complying with the requirements of ACI 304.
2. Do not begin placement until the WORK of other trades affecting concrete is completed.
3. Wet concrete and subgrade surfaces to a saturated surface dry condition immediately prior to placement of concrete.
4. Deposit concrete as near its final location as practical to avoid segregation due to re-handling or flowing.
5. Take care to avoid separation of the concrete mixture during transportation and placement. Concrete shall not be permitted to free fall for a distance greater than four feet during placement.
6. Concrete placement shall be completed within 90 minutes of the addition of water to the dry ingredients.

D. Consolidate placed concrete in accordance with ACI 309 using mechanical vibrating equipment supplemented with hand rodding and tamping, such that concrete is Worked around reinforcement and other embedded items and into all parts of formwork. Insert and withdraw vibrators vertically at uniformly spaced locations. Do not use vibrators to transport concrete within the formwork. Vibration of formwork or reinforcement shall not be permitted.

E. Protect concrete from physical damage or reduced strength due to weather extremes during mixing, placement, and curing.
1. In hot weather comply with the requirements of ACI 305.
2. In cold weather comply with the requirements of ACI 306.

3.4 QUALITY OF CONCRETE WORK

A. Make all concrete solid, compact, smooth and free of laitance, cracks and cold joints.

B. Cut out and properly replace to the extent directed by CQA MANAGER, or repair to the satisfaction of CQA MANAGER, surfaces which contain cracks or voids, are unduly rough or are in any way defective. Patches or plastering will not be acceptable.

D. Repair, removal and replacement of defective concrete as directed by CQA MANAGER shall be at no additional cost to OWNER.

3.5 CURING

A. Begin initial curing as soon as free water has disappeared from exposed surfaces. Where possible, keep continuously moist for not less than 72 hours. Continue curing by use of moisture-retaining cover or membrane-forming curing compound. Cure formed surfaces by moist curing until formwork is removed. Provide protection, as required, to prevent damage to exposed concrete surfaces. The total curing period shall not be less than seven days. Curing methods and materials shall be compatible with scheduled finishes.
3.6 FINISHING

A. Non-Formed Surfaces:
   1. All non-formed surfaces shall be screeded to the specified elevation, tamped with a
grid tamper until a thin layer of grout forms on the surface and floated with either a
hand or power float to finished grade such that the surface shall conform to the line
and grade desired when properly consolidated.
   2. The finished surface shall be free from porous spots, irregularities, depressions and
small pockets or rough spots such as may be caused by accidental disturbance or
by particles of coarse aggregate embedded near the surface.
   3. All contraction and expansion joints in the completed Work shall be left carefully
tooled and free of all mortar and concrete.
   4. Sawed joints shall be made less than 24 hours after placement of concrete or as
determined by the CONTRACTOR.

B. Formed Surfaces:
   1. Immediately following the removal of forms, all fins and irregular projections shall be
removed from all surfaces that are to be exposed. On all surfaces, cavities
produced by form ties, honeycomb spots, broken corners or edges and other
defects shall be thoroughly cleaned and, after having been kept saturated with water
for a period of not less than three hours, shall be carefully pointed and trued with a
mortar of cement and fine aggregate mixed in the proportions used in the concrete
being finished. Mortar used in pointing shall not be more than one (1) hour old. The
mortar patches shall be cured in the same manner as required for concrete.

3.7 CLEANING AND DISPOSAL

A. All materials and debris resulting from construction shall be removed from the Site
and properly disposed.

***END OF SECTION***
SECTION 31 05 19.13

GEOTEXTILES

PART 1 - GENERAL

1.1 SUMMARY

A. Scope:
   1. This section describes the general requirements for the manufacture, supply, installation, and quality control (QC) of geotextile fabric associated with the Work.
   2. The geotextile will be procured directly by the OWNER from the GEOSYNTHETICS MANUFACTURER. The CONTRACTOR shall be responsible for unloading, storing, and installing the geotextile fabric as specified.

B. RELATED SECTIONS
   1. Section 31 05 19.16 Geomembranes for Earthwork
   2. Section 31 05 19.23 Geosynthetic Clay Liners
   3. Section 31 23 00 Excavation and Fill
   4. Section 33 46 16 Subdrainage Piping

1.2 REFERENCES

A. Latest Version of American Society for Testing and Materials (ASTM) standards:
   2. ASTM D4491- Standard Test Methods for Water Permeability of Geotextiles by Permittivity
   4. ASTM D4632 - Standard Test Method for Breaking Load and Elongation of Geotextiles (Grab Method)
   5. ASTM D4751 - Standard Test Method for Measuring Geotextiles
   7. ASTM D5199 - Standard Test Method for Measuring Mass Per Unit Area of Geotextiles
   8. ASTM D5261- Standard Test Method for Measuring Mass Per Unit Area of Geotextiles

1.3 SUBMITTALS

A. The GEOSYNTHETICS MANUFACTURER shall provide the following information after Contract award, but no later than 14 days prior to material arrival on site and prior to commencement of the Work:
   1. Written certification that the geotextile to be used meets the requirements of the Project.
   2. Certificates of origin and the manufacturer of the resin
3. A copy of the manufacturer’s geotextile QC test results of properties outlined in Part 2 of this Section. The CQA MANAGER reserves the right to refuse use of any geotextile supplied without the proper QC documentation.

4. A detailed list of performance criteria for the geotextile material being produced for the Project. Refer to Part 2 of this Section for geotextile properties and test methods.

1.4 QUALITY ASSURANCE

A. The GEOSYNTHETICS MANUFACTURER shall ensure that their internal product quality control program meets the Contract requirements.

B. GEOSYNTHETICS MANUFACTURER shall provide required QC information at least 14 days prior to geotextile being shipped to the Site for review and approval by the OWNER’s REPRESENTATIVE. GEOSYNTHETICS MANUFACTURER shall also assure that the geotextile is delivered to the site at least five calendar days prior to installation.

C. Geotextile rolls that do not meet the performance criteria requirements shall be rejected. GEOSYNTHETICS MANUFACTURER shall be required to replace the rejected material with new material that complies with the performance criteria requirements, at no additional cost to OWNER.

1.5 DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping
1. Geotextile fabric shall be supplied in rolls wrapped in relatively impermeable and opaque protective covers, with straps for unloading.

2. Geotextile rolls shall be marked or tagged with the following information.
   a. Manufacturer's name
   b. Product information
   c. Roll number
   d. Batch of lot number
   e. Roll dimensions

3. The GEOSYNTHETICS MANUFACTURER shall ensure that geotextile rolls are properly loaded and secured to prevent damage during transit.

4. The GEOSYNTHETICS MANUFACTURER shall protect geotextile from excessive heat, puncture, cutting, or other damaging or deleterious conditions during shipping and delivery.

5. The GEOSYNTHETICS MANUFACTURER shall ensure personnel responsible for loading and transport are familiar with handling and transport constraints imposed by Manufacturer and as required by this SPECIFICATION.

6. The CONTRACTOR shall ensure personnel responsible for unloading and storing materials on site are familiar with handling and transport constraints imposed by Manufacturer and as required by this SPECIFICATION.

B. Acceptance at the Site
1. The CQA MANAGER shall perform inventory and surface inspection for defects and damage of all geotextile rolls upon delivery.

2. The CONTRACTOR shall unroll and allow for the CQA MANAGER inspection of any geotextile roll that may be damaged below surface layers.
3. The GEOSYNTHETICS MANUFACTURER shall repair damage resulting from handling and transport of geotextile to site at no cost to OWNER. If irreparable, in the opinion of CQA MANAGER, damaged materials shall be replaced at no cost to OWNER.

C. Storage and Protection
1. OWNER shall provide on-site storage area for geotextile rolls from time of delivery until installation.
2. The offloading and storage of the materials is the responsibility of the CONTRACTOR from the time the materials are off-loaded and inspected by the CQA MANAGER until the time the completed installation is accepted. CONTRACTOR is also responsible for offloading from shipper to storage and for preparing the storage location, off the ground, and for the protection of the material from the elements (e.g. ultraviolet light, moisture, temperature, etc.).
3. After CONTRACTOR has removed material from storage area, protect geotextile from puncture, dirt, groundwater, moisture, mud, mechanical abrasion, excessive heat, ultraviolet light exposure, and other sources of damage.
4. Geotextile rolls shall be stored in relatively opaque and water tight wrappings.
5. CONTRACTOR shall preserve integrity and readability of the geotextile roll labels, and store such that CQA MANAGER shall have access to the package slips or roll labels for each roll to verify roll acceptance. The CQA MANAGER will perform inventory and surface inspection for any defects or damage to rolls upon delivery. The GEOSYNTHETICS MANUFACTURER shall replace any defective or damaged rolls at no cost to the OWNER.

PART 2 - PRODUCTS

2.1 GEOTEXTILE FABRIC

A. The geotextile fabric shall be non-woven, needle punched, and shall be comprised of 95 percent polypropylene or polyester fibers by weight. Rolls shall be free of holes, contamination, and foreign matter. The geotextile for the project shall meet or exceed the minimum (unless noted otherwise) roll values shown in Table 31 05 19.13-1 below:

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<th>Fabric Property</th>
<th>ASTM Test Method</th>
<th>Unit</th>
<th>Minimum Value</th>
<th>Minimum Value</th>
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<tr>
<td>Mass Per Unit Area</td>
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<td>lbs</td>
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<td>Grab Strength</td>
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<td>Mullen Burst Strength</td>
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<td>Puncture Resistance</td>
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</tr>
</tbody>
</table>
PART 3 – EXECUTION

3.1 INSPECTION

A. CONTRACTOR shall verify the elevations and observe the conditions under which the Work is to be performed. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the CQA MANAGER.

B. CONTRACTOR shall review installation procedures under other Sections and coordinate the installation of items that must be installed prior to and/or with the geotextile fabric.

3.2 INSTALLATION

A. CONTRACTOR shall place geotextile fabric according to Manufacturer's recommendations.

B. Geotextile seams shall be secured in accordance with manufacturer's recommendations or as approved by CQA MANAGER. Geotextile seams shall be overlapped a minimum of 12 inches.

C. The CONTRACTOR shall examine the entire geotextile surface after installation to ensure, to the satisfaction of the CQA MANAGER that no potentially harmful foreign objects are present. Such foreign objects shall be removed and damaged geotextile shall be repaired or replaced by the CONTRACTOR at no cost to OWNER.

D. CONTRACTOR shall use care not to damage underlying materials during installation.

E. CONTRACTOR shall prevent the geotextile from accumulating excessive dust.

F. The CONTRACTOR shall be responsible for field handling, storing, deploying, seaming or connecting, temporary restraining (against wind), anchoring, and other aspects of geotextile installation.

G. The CONTRACTOR shall accept and retain full responsibility for all materials upon delivery to the Site through installation and shall be held responsible for any defects.

H. No equipment shall operate directly on geotextile fabric.

3.3 REPAIRS

A. Any holes or tears in the geotextile shall be repaired using a geotextile patch consisting of the same geotextile secured with a 12-inch overlap in all directions.

B. Damaged areas too large for patching shall be removed and replaced as directed by the CQA ENGINEER.
3.4 PLACEMENT OF SOIL OR GRANULAR MATERIALS

A. All soil or granular materials located on top of a geotextile shall be placed in such a manner as to ensure:
   1. The geotextile and/or underlying geosynthetic are not damaged.
   2. Minimal slippage of the geotextile on underlying layers occurs.
   3. Minimal movement and wrinkling or folding of the underlying geosynthetic layer(s) occurs.
   4. No excess tensile stresses shall occur in the geotextile, such as by earth moving equipment making sudden starts, stops, or turns. The allowable ground pressure for equipment shall be prescribed by these Specifications and/or the CQA MANAGER for the material type and layer thickness.

***END OF SECTION***
PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope
1. This section describes the general requirements for the manufacture, supply, installation, and quality control (QC) of High-Density Polyethylene (HDPE) geomembrane associated with the Work.
2. The geomembrane will be procured directly by the OWNER from the GEOSYNTHETICS MANUFACTURER. The CONTRACTOR shall be responsible for unloading, storing, and installing the geomembrane as specified.

B. Related Sections
1. Section 31 05 19.13 Geotextiles for Earthwork
2. Section 31 05 19.23 Geosynthetic Clay Liners
3. Section 31 23 00 Excavation and Fill

1.2 REFERENCES

A. Latest Version of American Society for Testing and Materials (ASTM) standards:
2. ASTM D1004 Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
3. ASTM D1204 Standard Test Method for Linear Dimensional Changes of Non-rigid Thermoplastic Sheet or Film at Elevated Temperature.
8. ASTM D5321 Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic Friction by the Direct Shear Method
9. ASTM D5397 Notched Constant Tensile Load Test for Geomembrane.
13. ASTM D6392 Standard Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods
1.3 PRE-QUALIFICATION

A. The GEOSYNTHETICS INSTALLER shall pre-qualify for geosynthetic installation by providing the following qualification documentation:
   1. The GEOSYNTHETICS INSTALLER shall have a minimum of 10,000,000 square feet (sf) of HDPE geosynthetic cumulative installation experience.
   2. The GEOSYNTHETICS INSTALLER shall provide at least three references from prior installation projects in excess of 500,000 sf including the following information:
      a. Client’s name, address, phone number and contact or representatives name.
      b. Project site and description.
      c. Geosynthetic type(s) and quantity installed.

B. The installation crew shall have the following experience.
   1. The superintendent shall have supervised the installation of a minimum of 2,000,000 ft² of polyethylene geomembrane and 500,000 ft² of geotextile.
   2. The master seamer shall have experience seaming a minimum of 1,000,000 ft² of polyethylene geomembrane using the same type of seaming apparatus to be used at this site.
   3. All other seaming personnel shall have seamed at least 100,000 ft² of polyethylene geomembrane using the same type of seaming apparatus to be used at this site. Personnel who have seamed less than 100,000 ft² of polyethylene geomembrane shall be allowed to seam only under the direct supervision of the master seamer or Superintendent.

1.4 SUBMITTALS

A. The GEOSYNTHETICS MANUFACTURER shall furnish the following in writing to the CQA MANAGER a minimum of fourteen (14) calendar days prior to geomembrane shipment to the site:
   1. Quality Control Program:
      a. Certificates for each shift’s production of geomembrane, and statements of production dates.
      b. Certification stating all geomembrane rolls are furnished by one manufacturer, and all rolls are manufactured from one resin type obtained from one resin supplier.
      c. Copies of quality control certificates, including:
         i. Roll numbers and identification;
         ii. Sampling procedures; and
         iii. Results of quality control tests, including descriptions of the test methods used.
      d. The results of the manufacturing quality control tests shall meet or exceed the property values listed in Table 31 05 19.16-1.
e. Geomembrane delivery, storage, handling and installation instructions.

2. Resin:
   a. Statement of production dates and origin of resin used to manufacture the geomembrane for the project.
   b. Certification stating all resin is from the same manufacturer and that reclaimed polymer added to the resin during the manufacturing of the geomembrane does not exceed 2 percent by weight.
   c. Copies of the quality control certificates issued by the manufacturer and resin supplier indicating that the resin used to manufacture the geomembrane meets these specifications.

3. Extrudate Beads and/or Welding Rod:
   a. Statement of production dates.
   b. Certification stating all extrudate is from one manufacturer, is the same resin type, and was obtained from the same resin supplier as the resin used to manufacture the geomembrane rolls.
   c. Copies of quality control certificates issued by the Manufacturer.

B. Prior to mobilization of the GEOSYNTHETICS INSTALLER to the Site, the GEOSYNTHETICS INSTALLER shall submit the following:

1. Shop drawings indicating panel layout and field seams. Each panel shall be assigned an identification number.
2. Installation schedule.
3. Copy of GEOSYNTHETICS INSTALLER letter of approval or license by the GEOSYNTHETICS MANUFACTURER.
4. Proposed installation capabilities, including:
   a. Information on equipment proposed for this project;
   b. Average daily production anticipated for this project; and
   c. Quality control procedures.
5. Resume of the superintendent and Quality Control Inspector for GEOSYNTHETICS INSTALLER to be assigned to this project, including dates and duration of employment. Substitution of these key personnel, without prior notification and approval by CQA MANAGER will be sufficient grounds for removal of GEOSYNTHETICS INSTALLER from the Project.
6. Resumes of all GEOSYNTHETICS INSTALLER personnel who will perform seaming operations on this project, including dates and duration of employment.

C. Immediately upon Notice of Award, CONTRACTOR shall make available to the CQA MANAGER samples of the geomembrane for interface shear testing and conformance testing.

D. During the installation, the GEOSYNTHETICS INSTALLER shall be responsible for the timely submission to the CQA MANAGER of subgrade acceptance certificates, signed by the GEOSYNTHETICS INSTALLER and CONTRACTOR, for each area to be covered by geosynthetic clay liner and geomembrane.

E. The GEOSYNTHETICS MANUFACTURER or GEOSYNTHETICS INSTALLER shall furnish the OWNER upon completion of the project:

1. A 20-year written warranty provided by the GEOSYNTHETICS MANUFACTURER against defects in material. Warranty conditions
concerning limits of liability will be evaluated and must be acceptable to the OWNER.

2. A 1-year warranty provided by the GEOSYNTHETICS INSTALLER against defects in workmanship. Warranty conditions concerning limits of liability will be evaluated and must be acceptable to the OWNER.

1.5 QUALITY ASSURANCE

A. All Work shall be constructed, monitored, and tested in accordance with the CQA Manual. The CONTRACTOR, GEOSYNTHETICS INSTALLER and GEOSYNTHETICS MANUFACTURER shall participate and comply with all items in the CQA Manual.

B. Geomembrane sampling shall be conducted by GEOSYNTHETICS INSTALLER in accordance with the specifications for the following:
   1. Conformance Testing
   2. Destructive Seam Testing

C. GEOSYNTHETICS INSTALLER shall attend a pre-installation conference. Attendance of parties directly affecting the WORK of this Section will be mandatory.

1.6 DELIVERY, STORAGE AND HANDLING

A. CONTRACTOR and GEOSYNTHETICS INSTALLER shall conform to the Manufacturer's requirements to prevent damage to geomembrane.

B. Transportation of the HDPE geomembrane by the GEOSYNTHETICS MANUFACTURER shall be through an independent trucking firm and shall be shipped via a closed or flatbed trailer.

C. Offloading and storage of the HDPE geomembrane shall be the responsibility of the CONTRACTOR. Handling and care of the HDPE geomembrane after acceptance by the CQA MANAGER, prior to and following installation, will be the responsibility of the GEOSYNTHETICS INSTALLER, until Final Acceptance of the liner system by the CQA MANAGER.

D. Delivery:
   1. GEOSYNTHETICS MANUFACTURER shall deliver materials to the site only after the CQA MANAGER approves the required submittals.
   2. All rolls of geomembrane delivered to the site shall be identified by the GEOSYNTHETICS MANUFACTURER at the factory with the following:
      a. Manufacturer’s name
      b. Product identification
      c. Lot number
      d. Roll number
      e. Roll dimensions
   3. CQA MANAGER and CONTRACTOR must be present when HDPE geomembrane is delivered to the site. GEOSYNTHETICS MANUFACTURER shall notify CQA MANAGER a minimum of 2 business days prior to delivery.
   4. CONTRACTOR is responsible for separating damaged rolls from undamaged rolls and storing at locations designated by the CQA MANAGER.
until proper disposition of material is determined by the OWNER and the CQA MANAGER.
5. The OWNER will be the final authority regarding damage.
6. CONTRACTOR shall separate rolls without proper documentation and store until the CQA MANAGER approval is received. Rolls or pallets without proper identification by GEOSYNTHETICS MANUFACTURER shall be subject to rejection.

E. On-site Storage:
1. CONTRACTOR shall store in space allocated by the OWNER.
2. Protect from puncture, dirt, grease, water, moisture, mud, mechanical abrasions, excessive heat or other damage.
3. Store on level prepared surface (not on wooden pallets).
4. Stack per Manufacturer's recommendation but no more than three rolls high.
5. CONTRACTOR shall preserve integrity and readability of the HDPE geomembrane roll labels, and store such that CQA MANAGER shall have access to the package slips or roll labels for each roll to verify roll acceptance.

F. On-site Handling:
1. GEOSYNTHETICS INSTALLER shall use appropriate handling equipment to load, move or deploy geomembrane rolls. Appropriate handling equipment includes cloth chokers and spreader bar for loading, spreader and roll bars for deployment. Dragging panels on ground surface will not be permitted.
2. GEOSYNTHETICS INSTALLER shall not fold geomembrane material; folded material shall be rejected.

G. Damaged Geomembrane:
1. Geomembrane damage will be documented by the CQA MANAGER.
2. Geomembrane found damaged upon arrival at the site shall be replaced by the GEOSYNTHETICS MANUFACTURER at no additional cost to the OWNER.

PART 2 - PRODUCTS
2.1 MATERIALS

A. The geomembrane shall be comprised of high-density polyethylene (HDPE) material as indicated in the Contract Drawings, manufactured of new, first-quality products designed and manufactured specifically for the purpose of liquid containment in hydraulic structures.

B. The geomembrane shall be produced free of holes, blisters, undispersed raw materials, or any sign of contamination by foreign matter. Any such defect shall be repaired in accordance with the repair procedures in this Section.

C. The geomembrane shall be manufactured with a minimum seamless width of 15 feet. There shall be no factory seams.

D. The primary geomembrane liner shall be HDPE 60 mil textured double-sided as indicated in the Contract Drawings.
E. The geomembrane shall be supplied in rolls; folds will not be permitted. Identify each roll with labels indicating lot number, roll number, thickness, length, width, manufacturer, and plant location.

E. Specifications for HDPE geomembrane properties are presented in Table 31 05 19.16-1. Supplied material shall conform to these properties based upon the manufacturer’s QC testing and CQA conformance testing.

G. Resin:
1. Shall be HDPE, new, first quality, compounded and manufactured specifically for producing HDPE geomembrane.
2. Do not intermix resin types.
3. Resin shall meet the following additional requirements of Table 31 05 19.16-2.

H. Extrudate Rod or Bead:
1. Shall be made from same resin as the geomembrane.
2. Additives shall be thoroughly dispersed.
3. Shall be free of contamination by moisture or foreign matter.
4. Shall meet the requirements of Table 31 05 19.16-3.
### TABLE 31 05 19.16-1
HDPE GEOMEMBRANE PROPERTIES

<table>
<thead>
<tr>
<th>Property</th>
<th>Qualifier</th>
<th>Units</th>
<th>Specification</th>
<th>Minimum Manufacturer QC Test Frequency</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thickness: 1. Minimum Average</td>
<td>min. avg.</td>
<td>mils</td>
<td>60</td>
<td>Per roll</td>
<td>ASTM D5994</td>
</tr>
<tr>
<td>Thickness: 2. Lowest individual for 8 of 10 values</td>
<td>min.</td>
<td>mils</td>
<td>54</td>
<td>Per roll</td>
<td>ASTM D5994</td>
</tr>
<tr>
<td>Asperity Height (1)</td>
<td>min. avg.</td>
<td>mil</td>
<td>16</td>
<td>Every 2nd roll</td>
<td>GM 12</td>
</tr>
<tr>
<td>Density</td>
<td>min. avg.</td>
<td>g/cc</td>
<td>0.940</td>
<td>200,000 lb</td>
<td>D792 or D1505</td>
</tr>
<tr>
<td>Tensile Properties (2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tensile Properties: 1. Yield Stress</td>
<td>min. avg.</td>
<td>lb/in</td>
<td>126</td>
<td></td>
<td>D638</td>
</tr>
<tr>
<td>Tensile Properties: 2. Break Stress</td>
<td>min. avg.</td>
<td>lb/in</td>
<td>90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tensile Properties: 3. Yield Elongation</td>
<td>min. avg.</td>
<td>%</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tensile Properties: 4. Break Elongation</td>
<td>min. avg.</td>
<td>%</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tear Resistance</td>
<td>min. avg.</td>
<td>Lb</td>
<td>42</td>
<td>45,000 lb</td>
<td>D1004</td>
</tr>
<tr>
<td>Puncture Resistance</td>
<td>min. avg.</td>
<td>Lb</td>
<td>90</td>
<td>45,000 lb</td>
<td>D4833</td>
</tr>
<tr>
<td>Stress Crack Resistance</td>
<td>Note 3</td>
<td>hours</td>
<td>500</td>
<td>per GM 10</td>
<td>D5397</td>
</tr>
<tr>
<td>Carbon Black Content (4)</td>
<td>range</td>
<td>%</td>
<td>2.0 – 3.0</td>
<td>20,000 lb</td>
<td>D1603</td>
</tr>
<tr>
<td>Carbon Black Dispersion (5)</td>
<td>rating</td>
<td>Cat.</td>
<td>Note 5</td>
<td>45,000 lb</td>
<td>D5596</td>
</tr>
<tr>
<td>Oxidative Induction Time (OIT) (6)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxidative Induction Time (OIT): Standard OIT, or High Pressure OIT</td>
<td>min. avg.</td>
<td>Min.</td>
<td>100</td>
<td>200,000 lb</td>
<td>D 3895</td>
</tr>
<tr>
<td>Oven Aging at 85˚ C (6)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Standard OIT (min avg) - % retained after 90 days; or</td>
<td>min. avg.</td>
<td>%</td>
<td>55</td>
<td>per each formulation</td>
<td>D 5721</td>
</tr>
<tr>
<td>(b) High Pressure OIT (min avg) - % retained after 90 days</td>
<td>min. avg.</td>
<td>%</td>
<td>80</td>
<td>per each formulation</td>
<td>D 3895</td>
</tr>
<tr>
<td>UV Resistance (7)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UV Resistance: High Pressure OIT (8) (min avg) - % retained after 1600 hrs</td>
<td>min. avg.</td>
<td>50</td>
<td>per each formulation</td>
<td>GRI GM 11</td>
<td></td>
</tr>
</tbody>
</table>

Notes
1. Lowest individual reading must be > 5 mil. Perform 10 readings for each side and calculate average for each side of every 2nd roll.
2. Type IV die ASTM D638 test specimen shall be used. Machine Direction (MD) and Cross Machine Direction (XMD) average values shall be on the basis of 5 test specimens each direction. Yield elongation is calculated using a gage length of 1.3 inches. Break elongation is calculated using a gage length of 2.0 inches.
3. The SP-NCTL test is not appropriate for testing geomembranes with textured or irregular rough surfaces. Test should be conducted on smooth edges of textured rolls or on smooth sheets made from the same formulation used for the textured sheet materials. The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer’s mean value via MQC testing.
4. Other means such as D 4218 (muffle furnace) are acceptable if an appropriate correlation to D 1603 (tube furnace) can be established.
5. Carbon Black Dispersion for 10 different views: All 10 in Categories 1 or 2
6. The manufacturer has the option to select either one of the OIT methods listed to evaluate the
antioxidant content in the geomembrane. Samples shall be evaluated at 30 and 60 days to compare with the 90-day response.

7. The condition of the test should be 20 hr. UV cycle at 75°C followed by 4-hr. condensation at 60°C.
8. The UV Resistance is based on the percent-retained value regardless of the original HP-OIT value.

TABLE 31 05 19.16-2
HDPE RESIN PROPERTIES

<table>
<thead>
<tr>
<th>Test (1,3)</th>
<th>Test Designation</th>
<th>Minimum Manufacturer QC Test Frequency</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>ASTM D 1505 or ASTM D 792 Method B</td>
<td>(2)</td>
<td>≥ 0.932</td>
</tr>
<tr>
<td>Melt Index</td>
<td>ASTM D 1238 Condition E</td>
<td>(2)</td>
<td>&lt; 1.0 g per 10 minutes</td>
</tr>
<tr>
<td>OIT</td>
<td>ASTM D 3895 (1 atm at 200°C)</td>
<td>(2)</td>
<td>≥ 100 minutes</td>
</tr>
</tbody>
</table>

Notes:
1. Resin without carbon black
2. One test per resin batch
3. The manufacturer may choose either Standard OIT or High Pressure OIT to evaluate antioxidant content

TABLE 31 05 19.16-3
EXTRUDATE OR BEAD PROPERTIES

<table>
<thead>
<tr>
<th>Test</th>
<th>Test Designation</th>
<th>Minimum Manufacturer QC Test Frequency</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>ASTM D 1505 or ASTM D 792 Method B</td>
<td>(1)</td>
<td>≥ 0.940</td>
</tr>
<tr>
<td>Carbon Black Content</td>
<td>ASTM D 1603</td>
<td>(1)</td>
<td>2-3%</td>
</tr>
<tr>
<td>Melt Index</td>
<td>ASTM D 1238 Condition E</td>
<td>(1)</td>
<td>&lt; 1.0 g per 10 minutes</td>
</tr>
</tbody>
</table>

Notes:
1. One test per resin lot or batch of extrudate or bead used for extrusion welding.
2.2 EQUIPMENT

A. Welding equipment and accessories of GEOSYNTHETICS INSTALLER shall meet the following requirements:
   1. Equipped with gauges showing temperatures both in apparatus and at nozzle (extrusion welder) or at wedge (fusion welder).
   2. Maintain adequate number of welding apparatus to avoid delaying work.
   3. Use power source capable of providing constant voltage under combined-line load.
   4. Provide secondary containment to catch spilled fuel under electric generator, if located on geomembrane.

B. GEOSYNTHETICS INSTALLER shall provide two (2) calibrated tensiometers (one for backup) capable of quantitatively measuring geomembrane strength:
   1. Equipped with gauge accurate to ±2 lbs per inch of geomembrane width and capable of pulling at 2 inches per minute and 20 inches per minute.
   2. Provide one inch die for cutting sample specimens.
   3. Provide certificate of tensiometer calibration within the past 12-months.
   4. CQA MANAGER shall be allowed to utilize tensiometers to conduct testing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. GEOSYNTHETICS INSTALLER shall verify in writing that the surface on which the geomembrane will be installed is acceptable. In so doing the Installation GEOSYNTHETICS INSTALLER shall assume full liability for the accepted surface.

B. The GEOSYNTHETICS INSTALLER shall be responsible for maintenance of the geomembrane covered geosynthetic clay liner once installation of geomembrane begins.

3.2 PREPARATION

A. GEOSYNTHETICS INSTALLER is to maintain the surface suitability and integrity until the lining installation is completed, leak location survey is completed and accepted.

B. GEOSYNTHETICS INSTALLER shall repair rough areas and any damage to the subgrade (below the geosynthetic clay liner) caused by installation of the lining and fill any ruts in subgrade caused by equipment prior to geosynthetic clay liner and geomembrane deployment.

3.3 DEPLOYMENT

A. Geomembrane shall not be deployed by GEOSYNTHETICS INSTALLER:
   1. During precipitation;
   2. In the presence of excessive moisture;
   3. In areas of ponded water;
   4. In the presence of excessive winds; and
   5. In excessive heat or cold.
B. Each panel shall be marked with an “identification code” (number or letter) by the GEOSYNTHETICS INSTALLER consistent with the layout plan. The identification code shall be simple and logical. The number of panels deployed in one day shall be limited by the number of panels which can be seamed on the same day. All deployed panels shall be seamed to adjacent panels by the end of each day.

C. The following is the acceptable method of deployment by GEOSYNTHETICS INSTALLER:
1. Use equipment which will not damage geomembrane by handling, trafficking, leakage of hydrocarbons or other means.
2. Do not allow personnel working on geomembrane to wear damaging shoes, or engage in activities that could damage geomembrane.
3. Smoking on the liner is prohibited.
4. Round sharp corners of clamps and other metal tools used in the WORK area.
5. Do not allow clamps and other metal tools to be tossed or thrown.
6. Unroll panels with a method that protects geomembrane from scratches and crimps and protects soil surface and underlying geosynthetic clay liner from damage.
7. Use a method to minimize wrinkles, especially differential wrinkles between adjacent panels.
8. Place adequate hold-downs to prevent uplift by wind.
9. Use hold-downs that will not damage geomembrane such as sandbags.
10. Use continuous hold-downs along leading edges to minimize risk of wind flow under panels.
11. Panels shall be deployed perpendicular to slope elevation contours and the generation of seams shall be minimized.
12. Protect geomembrane in heavy traffic areas by geotextile, extra geomembrane or other suitable materials.
13. Do not allow vehicular traffic including ATVs on geomembrane surface.
14. Panels deployed on grades steeper than 12% shall extend a minimum of 5 feet and less than 10 feet beyond the crest or toe of that slope.
15. Single-sided textured geomembrane shall be placed with textured side down.

D. GEOSYNTHETICS INSTALLER shall visually inspect sheet surface during unrolling of geomembrane and mark faulty or suspect areas for repair or test. Replace faulty (requires more than one patch per 200 square feet) geomembrane stock at no additional cost to the OWNER.

E. GEOSYNTHETICS INSTALLER shall deploy geomembrane in ambient temperatures less than 104 °F (40° C) and greater than 32° F (0° C), measured 6 inches above geomembrane surface. In prevailing warm or cold weather conditions deployment may be acceptable if the provisions for sampling in such conditions is satisfied (see Section 3.5 below). The geomembrane shall not be deployed during precipitation, in the presence of excessive moisture, in areas of ponded water, or in the presence of excessive winds.

F. GEOSYNTHETICS INSTALLER shall deploy HDPE in a relaxed manner and free of tension and stress. In areas where grade transitions occur, the geomembrane shall not be allowed to bridge or trampoline.
3.4 FIELD SEAMING BY GEOSYNTHETICS INSTALLER

A. Orient seams perpendicular to slope elevation contours, i.e., orient down (not across) slope and use seam numbering system compatible with panel number system.

B. Minimize the number of field seams in corners, odd-shaped geometric locations and outside corners.

C. Overlap panels by a minimum of 3 inches for extrusion welding and 4 inches for fusion welding. Use procedures to temporarily bond adjacent panels together that do not damage the geomembrane and that are not detrimental to seam weld material for extrusion welding.

D. Do not use solvent or adhesive unless product is approved in writing by the CQA MANAGER.

E. No horizontal seams shall be allowed on grades steeper than 12% or within 5 feet to 10 feet of the crest or toe of slopes. A horizontal seam is defined as more than half of the panel width.

F. Clean surface of grease, moisture, dust, dirt, debris or other foreign material.

G. Prior to any extrusion welding, the geomembrane seam or repair shall be prepared as follows:
   1. Clean surface of oxidation by disc grinder or equivalent not more than one hour before seaming; use number 80 grit sandpaper for the disc grinder. Bevel edges of geomembrane before bonding and provide continuous tacking in repair areas.
   2. Repair area where excessive grinding substantially reduces sheet thickness by more than 4 mils beyond extents of weld.
   3. Clean grinding dust around weld area after grinding.
   4. The following procedure shall be followed for wrinkles and fishmouths.
      a. Cut along the ridge of the wrinkle or fishmouth.
      b. Overlap a minimum of 3 inches and seam.
      c. Any portion where the overlap is less than 3 inches shall be patched with an oval or round patch of geomembrane that extends a minimum of 6 inches beyond the cut in all directions.
   5. If required, a firm, dry substrate (piece of geomembrane or other material) may be placed directly under the seam overlap to achieve proper support.
   6. Keep water from intercepting the weld during and immediately after welding the seam.
   7. For existing welds, or welds that are over 10 minutes old, grind the existing weld two inches back from point of termination and restart welding on ground weld.

H. At least one spare operable seaming apparatus shall be maintained for every three seaming teams. Place protective fabric or piece of geomembrane beneath hot
welding apparatus when resting on geomembrane lining and use an electric generator capable of providing constant voltage under combined line load. The electric generator shall be located outside of liner unless otherwise approved by CQA MANAGER. Provide protective lining and secondary containment large enough to catch spilled fuel under electric generators approved to operate on the liner. The welding apparatus shall be equipped with gauges giving temperatures in apparatus and at nozzle.

I. For extrusion welding, purge welding apparatus of heat-degraded extrudate before welding if extruder is stopped for longer than five minutes. All purged extrudate shall be disposed of off the geomembrane. Each extruder shoe shall be inspected daily for wear to assure that its offset is the same as the geomembrane thickness. Repair or replace worn shoes, damaged or mis-aligned armature brushes, nozzle contamination, or other worn or damaged parts. Avoid stop-start welding. Remove extrudate rod from welder when not using welder for long periods (over two hours). No welding may commence on the liner until the field trial seam sample, made by that equipment and seamer, passes destructive testing.

J. Test and set “hot air system” using scrap material at least each day prior to commencing seaming and adjust hot air velocity to preclude wind effects. Adjust contact pressure rollers to prevent surface ripples in sheet. No equipment shall be used for welding the geomembrane until a field trial seam sample made by that equipment has passed destructive testing.

K. In performing hot wedge welding, the welding apparatus shall be automated vehicular mounted devices equipped with gauges giving applicable temperatures and pressures. The edge of cross seams shall be ground to a smooth incline (top and bottom) prior to welding. A smooth insulating plate or fabric shall be placed beneath the hot welding apparatus after usage. Protect against moisture buildup between sheets. If welding across cross seams, conduct field test seams at least every two hours, otherwise once prior to start of work and once at mid-day. No equipment is allowed to commence welding on geomembrane until the field trial seam sample made by that piece of equipment has passed destructive testing.

L. Field trial seams shall be conducted, per seaming apparatus and per seamer, on pieces of geomembrane liner to verify adequate seaming conditions at the following frequency:
   1. At beginning of each seaming period.
   2. At least once every five hours.
   3. At the discretion of the CQA MANAGER

M. Make the trial seams at area of seaming and in contact with subgrade or geosynthetic clay liner (same condition as the liner to be seamed). The seam sample shall be at least 42 inches long and 12 inches wide with the seam centered lengthwise. A one-foot length of each trial seam sample shall be submitted to the CQA MANAGER for archives. Cut three 1-inch wide specimens and test two for peel adhesion, and one for bonded seam strength (shear). Each double wedge fusion seam specimens shall be tested for peel on both sides of the weld. CQA MANAGER shall have access to use GEOSYNTHETICS INSTALLER tensiometer. A specimen passes when:
   1. The break is film tearing bond (FTB) conforming to the values shown in Table 31 05 19.16-4.
2. The break is ductile.
3. The strength of breaks for the trial seam testing shall conform to the values listed in Table 31 05 19.16-4.

**TABLE 31 05 19.16-4**
HDPE GEOMEMBRANE SEAM PROPERTIES

<table>
<thead>
<tr>
<th>Property</th>
<th>Qualifier</th>
<th>Units</th>
<th>Specification</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shear Seam Strength</td>
<td>Min &gt;</td>
<td>lb/in.</td>
<td>120</td>
<td>ASTM D6392</td>
</tr>
<tr>
<td>Shear Elongation at break</td>
<td></td>
<td>%</td>
<td>50</td>
<td>ASTM D6392</td>
</tr>
<tr>
<td>Peel Adhesion</td>
<td>min</td>
<td>lb/in.</td>
<td>91</td>
<td>ASTM D6392</td>
</tr>
<tr>
<td>Fusion</td>
<td></td>
<td></td>
<td>78</td>
<td>ASTM D6392</td>
</tr>
<tr>
<td>Extrusion</td>
<td>min</td>
<td>lb/in.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peel Separation</td>
<td>Maximum</td>
<td>%</td>
<td>25</td>
<td>ASTM D6392</td>
</tr>
<tr>
<td>Fusion/Extrusion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. Manufacturers use g/10 min as units.
2. All values, except when specified as minimum or maximum, represent average lot property values.
4. Film Tear Bond (FTB) is defined as failure of one of the sheets by tearing, instead of separating from the other sheet at weld interface area (sheet fails before weld).
5. Units, English or metric, shall be consistent with manufacturers specifications.
6. FTMS 101C Method 2065.

N. A trial seam sample passes when all specimens have passing results in peel and shear tests. If a specimen fails (one of the specimens fails in either peel or shear mode), the trial seam procedure shall be repeated in its entirety. If the repeated trial seam fails, the seaming apparatus or operator may not weld until the deficiencies or conditions are corrected and two consecutive passing field trial seams are achieved.

O. The following procedures shall be followed during cold weather conditions.
1. Geomembrane surface temperatures shall be determined by the CQA MANAGER at intervals of at least once per 100 feet of seam length to determine if preheating is required. For extrusion welding, preheating is required if the surface temperature of the geomembrane is below 32° F (0° C).
2. For fusion welding, preheating may be waived by the CQA MANAGER if the GEOSYNTHETICS INSTALLER demonstrates to the CQA MANAGER’s satisfaction that welds of equivalent quality may be obtained without preheating at the expected temperature of installation.
3. If preheating is required, the CQA MANAGER will observe all areas of geomembrane that have been preheated by a hot air device prior to seaming, to ensure that they have not been overheated.
4. Care shall be taken to confirm that the surface temperatures are not lowered below the minimum surface temperatures specified for welding due to winds or other adverse conditions. It may be necessary to provide wind protection for the seam area.
5. All preheating devices shall receive approval by the CQA MANAGER prior to use.
6. Additional destructive tests will be taken at an interval between 250 and 500 feet of seam length, at the discretion of the CQA MANAGER.
7. Sheet grinding may be performed before preheating, if applicable.
8. Trial seaming shall be conducted under the same ambient temperature and preheating conditions as the production seams. Under cold weather conditions, new trial seams shall be conducted if the ambient temperature drops by more than 20°F from the initial trial seam test conditions. Such new trial seams shall be conducted upon completion of seams in progress during the temperature drop.

P. The following procedures shall be followed during warm weather conditions.
1. At ambient temperatures above 104°F (40°C), no seaming of the geomembrane shall be permitted unless the Installation GEOSYNTHETICS INSTALLER can demonstrate to the satisfaction of the CQA MANAGER that the geomembrane seam quality is not compromised. Trial seaming shall be conducted under the same ambient temperature conditions as the production seams. At the option of the CQA MANAGER, additional destructive testing or trial seaming may be required for any suspected areas.

3.5 FIELD QUALITY CONTROL BY GEOSYNTHETICS INSTALLER

A. The GEOSYNTHETICS INSTALLER shall designate a full-time quality control (QC) technician who shall be responsible for supervising and/or conducting the field quality control program. The QC technician may not be replaced without written authorization by the CQA MANAGER.

B. All documentation will be completed on a daily basis by the GEOSYNTHETICS INSTALLER in a neat orderly manner, checked for computations and errors prior to turnover, along with a daily QC summary report.

C. Non-Destructive Seam Testing by GEOSYNTHETICS INSTALLER
1. The GEOSYNTHETICS INSTALLER shall non-destructively test field welds for continuity over their full length using vacuum test units or air pressure testing. The non-destructive testing shall be performed concurrently with seaming WORK progress, not at the completion of all seaming. Any defects located in the seam shall be repaired in accordance with Section 3.6. The following non-destructive testing procedures shall be used to test the field seams for continuity.
   a. Vacuum box testing for extrusion welds.
   b. Air pressure testing for double fusion seams.

2. Vacuum Box Testing
   a. The vacuum box testing equipment shall comprise the following.
      i. Rigid housing; transparent viewing window; a soft rubber gasket attached to bottom of housing; porthole or valve assembly; and a vacuum gauge.
      ii. A vacuum pump capable of applying 5 psi gage pressure of vacuum to the box.
      iii. A bucket of soapy solution and applicator.
   b. The procedure for vacuum testing is as follows:
i. Clean window, gasket surfaces, and check for leaks.
ii. Energize vacuum pump and reduce tank pressure to approximately 5 psi.
iii. Wet a strip of geomembrane approximately 12 inches by 30 inches (length of box) with soapy solution.
iv. Place box over wetted area and compress.
v. Close bleed valve and open vacuum valve.
vi. Ensure that a leak tight seal is created.
vii. Examine length of weld through viewing window for presence of soap bubbles for a period of not less than 10 seconds.
viii. If no bubbles appear after 10 seconds, close vacuum valve and open bleed valve, move box over next adjoining area with minimum three inches overlap and repeat process.
ix. Areas where soap bubbles appear will be marked by the CQA MANAGER with a defect code. The Installer shall then repair the area in accordance with Section 3.6 and retest the repaired area.

3. Air Pressure Testing (Double Fusion Seams Only)
a. The air pressure testing equipment shall comprise the following.
   i. An air pump, equipped with pressure gauge with an accuracy of 1 psi, capable of generating and sustaining a pressure between 27 to 30 psi and mounted on a cushion to protect geomembrane.
   ii. Rubber hose with fittings and connections.
   iii. Sharp hollow needle or other pressure feed device approved by the CQA MANAGER.

b. To perform the test:
   i. Seal both ends of the seam to be tested.
   ii. Insert a needle or other approved pressure feed device into tunnel created by double hot wedge seaming and insert a protective cushion between air pump and geomembrane.
   iii. Energize air pump to 27 to 30 psi, close valve, and sustain pressure for a minimum of five minutes.
   iv. If loss of pressure exceeds 2 psi or does not stabilize, locate faulty area and repair in accordance with Section 3.6.
   v. Release pressure at opposite end of seam from gauge to verify that the seam is not blocked.
   vi. Remove approved pressure feed device and seal penetration holes by extrusion welding.

C. Destructive Seam Testing

1. For destructive seam testing, the CQA MANAGER shall be provided with a minimum of one sample per 1000 feet of seam length by each welding apparatus. The location will be selected by the CQA MANAGER and the GEOSYNTHETICS INSTALLER will not be informed of the sample location in advance. The GEOSYNTHETICS INSTALLER shall visually observe, mark and repair suspect welds before release of a section to the CQA MANAGER for destructive sample marking. Cut destructive samples as seaming and nondestructive testing progresses, prior to completion of liner installation. The CQA MANAGER will mark destructive samples with consecutive numbering, location, apparatus I.D., technician I.D., CQA MANAGER I.D., and apparatus settings and date. Record, in written form,
weld and test date, time, location, seam number, ambient temperatures, machine settings, technician I.D., apparatus I.D., and pass or fail description. The GEOSYNTHETICS INSTALLER shall immediately repair holes in geomembrane resulting from obtaining destructive samples and vacuum test patches. The size of destructive samples shall be 12 inches wide by 48 inches long with seam centered lengthwise.

2. Two 1-inch wide specimens shall be taken from each side of the sample and tested by the Installation GEOSYNTHETICS INSTALLER for peel and shear in the field prior to CQA destructive testing. If any of these specimens fail, the GEOSYNTHETICS INSTALLER shall track the failure immediately. The remaining sample shall be cut into three 14-inch long pieces and distributed as follows:
   a. To the CQA MANAGER for destructive testing.
   b. To the CQA MANAGER for archive.
   c. To the GEOSYNTHETICS INSTALLER for his/her use.

3. The GEOSYNTHETICS INSTALLER shall cut ten 1-inch wide specimens from one piece. Five specimens shall be tested for peel and five for shear strengths in accordance with the CQA Plan, with test results meeting the requirements of Table 31 05 19.16-4. CQA MANAGER AND/OR CQA MONITORS shall have access to use either of the GEOSYNTHETICS INSTALLER tensiometers. In the event of failure, the procedures for failed seam tracking are:
   a. Retrace welding path a minimum of 10 feet in both directions from the failed test location and remove (at these locations) a one inch wide specimen for testing. Repeat tracking procedures until the GEOSYNTHETICS INSTALLER is confident of seam quality.
   b. Obtain destructive samples from each side of the welding path and distribute, as described above, to the CQA MANAGER for destructive testing.
   c. Repeat process if additional tests fail.
   d. Reconstruct seam between passing test locations to satisfaction of the CQA MANAGER.
   e. Reconstruction may be one of the following:
      i. Cut out old seam, reposition panel and re-seam.
      ii. Add cap strip.
   f. Cut additional destructive samples from reconstruction at discretion of CQA MANAGER.
   g. If additional destructive sample results are not acceptable, repeat process until reconstructed seam is judged satisfactory by the CQA MANAGER.

D. For final seaming inspection, check the seams and surface of geomembrane for defects, holes, blisters, undispersed raw materials, or signs of contamination by foreign matter. Brush, blow, or wash geomembrane surface if dirt inhibits inspection. The CQA MANAGER shall decide if cleaning of geomembrane surface and welds is needed to facilitate inspection. Distinctively mark repair areas and indicate required type of repair.

3.6 REPAIR PROCEDURES FOR GEOSYNTHETICS INSTALLER

A. The geomembrane will be inspected before and after seaming for evidence of defects, holes, blisters, undispersed raw materials, and any sign of contamination by
foreign matter. The surface of the geomembrane shall be clean at the time of
inspection. The geomembrane surface shall be swept or washed by the
GEOSYNTHETICS INSTALLER if surface contamination inhibits inspection. The
GEOSYNTHETICS INSTALLER shall ensure that an inspection of the geomembrane
precedes any seaming of that section.

B. Remove damaged geomembrane and replace with acceptable geomembrane
materials if damage cannot be satisfactorily repaired.

C. Repair, removal and replacement shall be at the GEOSYNTHETICS INSTALLER
expense if the damage results from the GEOSYNTHETICS INSTALLER activities.

D. Fishmouths shall be slit, laid flat, and seamed with a minimum overlap of 3 inches.
Any portion where the overlap is less than 3 inches shall be patched with an oval or
round patch of geomembrane that extends a minimum of 6 inches beyond the cut in
all directions.

E. Repair any portion of the geomembrane exhibiting a flaw, or failing a destructive or
non-destructive test. The GEOSYNTHETICS INSTALLER shall be responsible for
repair of damaged or defective areas. Agreement upon the appropriate repair
method shall be decided between the CQA MANAGER and the GEOSYNTHETICS
INSTALLER. Procedures available include:
1. Patching: Used to repair holes (over 1/4-inch diameter), tears (over 1/4 inch
long), undispersed raw materials, and contamination by foreign matter.
2. Grinding and welding: Used to repair pinholes, blemishes and over-grinding.
4. Removing the seam and replacing with a strip of new material.

F. In addition, the following procedures shall be observed.
1. Geomembrane surfaces to be repaired shall be abraded (extrusion welds
only) no more than 1/2 hour prior to the repair.
2. All geomembrane surfaces shall be clean and dry at the time of repair.
3. The repair procedures, materials, and techniques shall be approved in
advance of the specific repair by the CQA MANAGER.
4. Extend patches or caps at least 6 inches beyond the edge of the defect, i.e.,
patch or cap shall be a minimum of 12 inches in diameter, and round all
corners of material to be patched.
5. Bevel the edge of the patch and do not cut patch with repair sheet in contact
with geomembrane. Temporary bond the patch to the geomembrane with
an approved method, extrusion weld the patch and then vacuum test the
repair.
6. All panel intersections (T-seams) shall be repaired with a patch.

G. Repair Verification:
1. Number and log each patch repair (performed by the CQA MANAGER).
2. Non-destructively test each repair using methods specified in this Section.
3. Provide daily documentation of non-destructive and destructive testing to the
CQA MANAGER. The documentation shall identify seams that initially failed
the test and include the evidence that these seams were repaired and
retested successfully.
3.7 ACCEPTANCE

A. The GEOSYNTHETICS INSTALLER shall retain ownership and responsibility for the geomembrane until acceptance by the OWNER.

B. Acceptance Criteria: The following shall be completed:
   1. Verification of adequacy of field seams, repairs and testing by the CQA MANAGER including leak survey.
   2. All submittals.
   3. As-built drawings, approved and final drawings submitted.
   4. Construction area cleaned.
   5. Final field inspection
   6. Warranty signed over to the OWNER.

C. Field Inspections: Inspect the completed Work with the CQA MANAGER; defects, wrinkles, suspicious looking welds shall be noted and marked; document, correct and arrange further field inspections until no corrective action is necessary.

3.8 CONFORMANCE TESTING

A. Material will be made available to the CQA MANAGER by the GEOSYNTHETICS MANUFACTURER upon notice to proceed for conformance sampling and testing at a minimum frequency of one per 100,000 square feet of material continuously produced and supplied to the project, with a minimum of one sample per production lot. Materials may be sampled at the plant at the option of the OWNER.

B. As a minimum, the following tests will be performed by a geosynthetics CQA laboratory and shall meet the requirements outlined in Table 31 05 19.16-1.
   1. Thickness (ASTM D5994)
   2. Specific Gravity (ASTM D1505)
   3. Carbon Black Content (ASTM D1603)
   4. Carbon Black Dispersion (ASTM D5596)
   5. Tensile Properties (ASTM D638)
   6. Puncture Resistance (ASTM D4833)
   7. Asperity Height (GRI GM 12)

C. If a test result is in non-conformance with the SPECIFICATIONS, all material from that production lot represented by the failed test shall be rejected. Rejected material may be minimized by bounding the nonconformance material with additional passing tests conducted by the geosynthetics CQA laboratory. Additional tests shall be conducted by the GEOSYNTHETICS MANUFACTURER at no additional cost to the OWNER.

D. Rejected material shall be replaced at no additional cost to OWNER.

3.9 ANCHOR TRENCH

A. The CONTRACTOR shall excavate the anchor trenches to the lines, grades, and width shown in the DRAWINGS, prior to any geosynthetic material placement. CQA MANAGER shall verify that the anchor trench has been constructed according to the DRAWINGS.
B. The anchor trench shall be backfilled and compacted as approved by the CQA MANAGER. Trench backfill material shall be placed in 9 to 12-inch thick loose lifts and compacted by wheel rolling with light, rubber-tired or other light compaction equipment, as approved by CQA MANAGER.

C. Care shall be taken when backfilling the trenches to prevent any damage to the geosynthetic materials. At no time shall construction equipment come into direct contact with the geosynthetic materials. If damage occurs, it shall be repaired by the GEOSYNTHETICS INSTALLER prior to the completion of backfilling, at no cost to OWNER.

D. CONTRACTOR shall extend geosynthetic materials into the anchor trench as shown in the DRAWINGS. The geosynthetic materials shall be seamed, bonded, or attached along the entire distance of the anchor trench, using approved methods described in this Section.

3.10 PLACEMENT OF SOIL OR GRANULAR MATERIALS

A. All soil materials located on top of a geomembrane shall be placed by the CONTRACTOR in such a manner as to ensure:
   1. The geomembrane and any underlying geosynthetic material is not damaged.
   2. Minimal slippage of the geomembrane on underlying layers occurs.
   3. Minimal movement and wrinkling or folding of the underlying geosynthetic layer(s) occurs.
   4. No excess tensile stresses shall occur in the geomembrane, such as by earth moving equipment making sudden starts, stops, or turns. The allowable ground pressure for equipment shall be prescribed by CQA MANAGER for the material type and layer thickness.

3.11 SURVEY CONTROL

A. CQA MANAGER will perform survey of final surface area of geosynthetics to determine quantities for payment purposes.

B. GEOSYNTHETICS INSTALLER shall provide CONTRACTOR and CQA MANAGER with record drawings of geomembrane panel locations and extent of the geomembrane. Drawings shall be submitted in both electronic and hardcopy format.

***END OF SECTION***
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. This Section includes requirements for the manufacture, supply, and installation of geocomposite for the project and the construction CQA monitoring and testing. All procedures, operations, and methods shall be in strict compliance with the Specifications, CQA Plan, and the Drawings.

1.2 REFERENCES

A. ASTM D1238 – Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
D. ASTM D4716-00 – Standard Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
E. ASTM D5199 - Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes

1.3 SUBMITTALS

A. Contractor shall provide the following information after contract award but at a minimum fourteen (14) days prior to shipping of geocomposite for review and approval by CQA MANAGER:
   1. Information from Manufacturer including company name, address, telephone number, the names of the company president and QC manager, and narrative of the company history.
   2. A list of standard material properties and test methods employed to arrive at the values for each. As a minimum, the list shall include properties given in Part 2.1 of this Section.
   3. The QC Manual followed during the manufacturing process including those for the polymer material and for detecting foreign objects in the finished goods, and a description of the QC laboratory facilities, including the name and telephone number of the QC manager.

B. Contractor shall submit the following geocomposite Manufacturer’s documentation on the raw materials used to manufacture the geocomposite:
1. QC certificates issued by the raw material supplier including the production dates of the raw material used to manufacture the geocomposite for the project.

2. Results of tests conducted by the geocomposite Manufacturer to verify the quality of the resin used to manufacture the geonet assigned to the project and the origin of the resin and QC certificates issued by the resin supplier.

3. Certification that no reclaimed polymer was used in the manufacturing of the geonet to be used for the project.

C. A copy of the Geocomposite Manufacturer’s QC Program.

D. QC certificates for test results at the sampling frequency indicated by the Manufacturer’s QC Plan shall be submitted. The CQA MANAGER reserves the right to refuse use of any geocomposite supplied without the proper QC documentation.

1. Manufacturing QC certificates for each shift’s production shall be signed by responsible parties employed by the Manufacturer (such as the Production Manager).

2. The QC certificates shall include:
   a. Roll numbers and identification
   b. Sampling procedures
   c. Results of the QC tests verifying each of the properties listed in Part 2.1 of this Section
   d. Transmissivity tests do not need to be completed as routine QC tests. However, Manufacturer shall include a written statement that the product has been tested and meets or exceeds the transmissivity requirements. Tests results shall be included
   e. A detailed list of performance criteria for the geocomposite material being produced for this project. (Note: Performance criteria are sometimes referred to as “minimum property values.” Refer to Part 2.1 of this Section for geocomposite properties and test methods.)

1.4 QUALITY ASSURANCE

A. All work shall be constructed, monitored, and tested in accordance with the Manufacturer’s CQA plan. The Contractor and Manufacturer shall participate and comply with all items in these specifications and requirements of the CQA plan.

B. Contractor shall ensure that geocomposite Manufacturer has an internal product QC program that meets Contract requirements.

C. Contractor shall be aware of all activities outlined in the CQA plan, and Contractor shall account for these activities in the construction schedule.

D. The Contractor will provide required QC information at least fourteen (14) days prior to geosynthetics being shipped to the project for review and approval by the Construction Manager and/or Engineer. Contractor shall also assure that the geocomposite is delivered to the site at least five (5) calendar days prior to installation. Conformance testing must be completed, reviewed, and approved by the Construction Manager and/or Engineer prior to shipping of geocomposite to the site.
E. Geocomposite that does not meet the requirements of this specification and the Manufacturer’s CQA plan shall be rejected. Contractor shall be required to replace the rejected material with new material that complies with the specifications.

F. In order to prevent weather damaged geocomposite from being placed, the following QA procedures shall be followed:
   1. Contractor shall perform its work and utilize sufficient ballast as necessary to prevent wind uplift of the geocomposite.
   2. If weather damage should occur, Construction Manager shall determine if the geocomposite shall be repaired or replaced. Weather damage to the geocomposite will include tears and dirty fabric, as determined by the Construction Manager or CQA Monitor.
   3. Repair or replacement of the weather-damaged geocomposite shall be completed by Contractor.

G. Conformance Testing
   1. During manufacturing of the geocomposite, the CQA Monitor will facilitate the collection of samples to the QA Testing Laboratory for testing to ensure conformance with the specifications.
   2. Samples will be taken across the entire width of the roll and shall not include the first 3 ft. Unless otherwise stated, samples will be 3 ft long by the width of the roll. The CQA Monitor will mark the machine direction on the samples with an arrow.
   3. Conformance testing must be completed, reviewed, and approved by Construction Manager or Engineer prior to shipping of geocomposite to the site. Conformance samples shall be collected at the frequencies defined in the CQA Plan. Tests will be performed on the geocomposite to verify conformance to the design specifications with minimum values specified in Part 2.1 of this Section.
   4. If a test result is in nonconformance with the specifications, all material from that production lot presented by the failed test shall be rejected. Rejected material may be minimized by bounding the nonconformance material with additional passing tests conducted by the geosynthetic CQA laboratory.
   5. Rejected material shall be replaced.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping
   1. Geocomposite shall be supplied in rolls wrapped in relatively impermeable and opaque protective covers, with straps for unloading.
   2. Geocomposite rolls shall be marked or tagged with the following information.
      a. Manufacturer’s name
      b. Product information
      c. Roll number
      d. Batch or lot number
      e. Roll dimensions
   3. Contractor shall ensure that geocomposite rolls are properly loaded and secured to prevent damage during transit.
4. Contractor shall protect geocomposite from excessive heat, cold, puncture, cutting, or other damaging or deleterious conditions.
5. Contractor shall ensure personnel responsible for loading, transport, and unloading of geocomposite are familiar with handling and transport constraints imposed by Manufacturer.

B. Acceptance at Site
1. CQA Monitor shall perform inventory and surface inspection for defects and damage of all geocomposite rolls upon delivery.
2. Contractor shall unroll and inspect any geocomposite roll that may be damaged below surface layers.
3. Contractor shall repair damage resulting from handling and transport of geocomposite. If irreparable, in the opinion of CQA Monitor, damaged materials shall be replaced.

C. Storage and Protection
1. Manager shall provide on-site storage area for geocomposite rolls from time of delivery until installation.
2. The storage of the materials is the responsibility of Contractor from the time the materials are off-loaded until the time the completed installation is accepted. Contractor is responsible for preparing the storage location, off the ground, and for the protection of the material from the elements (e.g., ultraviolet light, moisture, temperature, etc.).
3. After Contractor has removed material from storage area, protect geocomposite from puncture, dirt, groundwater, moisture, mud, mechanical abrasion, excessive heat, ultraviolet light exposure, and other sources of damage.
4. Geocomposite rolls shall be stored in relatively opaque and watertight wrappings.
5. Contractor shall preserve integrity and readability of the geocomposite roll labels, and store such that Construction Manager shall have access to the package slips or roll labels for each roll to verify roll acceptance.

1.6 WARRANTY
A. Special Warranty: Manufacturer’s standard form in which Manufacturer agrees to repair or replace components of equipment that fails in materials or workmanship within specified warranty period.
1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS
A. Geocomposite shall be high-density polyethylene (HDPE) and manufactured by extruding two crossing strands to form a bi-planer drainage net structure with a non-woven geotextile bonded to both sides.

B. The geonet shall be comprised of a minimum 95 percent pure polyethylene. The remaining portion shall be made up of materials necessary for the performance of the geonet (such as carbon black, anti-oxidants, etc.).
C. The geocomposite used for the work shall meet or exceed (unless noted otherwise) the minimum properties listed in the Table 31 05 19.25-1 for an 8oz/sq geocomposite:
### TABLE 31 05 19.22-1
GEOCOMPOSITE PROPERTIES

<table>
<thead>
<tr>
<th>Tested Property</th>
<th>Test Method</th>
<th>Frequency</th>
<th>Minimum Average Roll Value&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geocomposite</td>
<td></td>
<td>6 oz/yd&lt;sup&gt;2&lt;/sup&gt;</td>
<td>8 oz/yd&lt;sup&gt;2&lt;/sup&gt;</td>
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<tr>
<td>Product Code</td>
<td></td>
<td>F420600605</td>
<td>F420800805</td>
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<tr>
<td>Transmissivity&lt;sup&gt;b&lt;/sup&gt;, gal/min/ft (m&lt;sup&gt;3&lt;/sup&gt;/sec)</td>
<td>ASTM D 4716</td>
<td>1/540,000 ft&lt;sup&gt;2&lt;/sup&gt;</td>
<td>0.48 (1 x 10&lt;sup&gt;−4&lt;/sup&gt;)</td>
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<tr>
<td>Ply Adhesion, lb/in (g/cm)</td>
<td>ASTM D 7005</td>
<td>1/50,000 ft&lt;sup&gt;2&lt;/sup&gt;</td>
<td>1.0 (178)</td>
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<tr>
<td>Roll Width&lt;sup&gt;c&lt;/sup&gt;, ft (m)</td>
<td></td>
<td>14.5 (4.4)</td>
<td>14.5 (4.4)</td>
</tr>
<tr>
<td>Roll Length&lt;sup&gt;d&lt;/sup&gt;, ft (m)</td>
<td></td>
<td>230 (70.1)</td>
<td>200 (60.9)</td>
</tr>
<tr>
<td>Roll Area, ft&lt;sup&gt;2&lt;/sup&gt; (m&lt;sup&gt;2&lt;/sup&gt;)</td>
<td></td>
<td>3,335 (310)</td>
<td>2,900 (269)</td>
</tr>
<tr>
<td>Geonet core&lt;sup&gt;e&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transmissivity, gal/min/ft (m&lt;sup&gt;3&lt;/sup&gt;/sec)</td>
<td>ASTM D 4716</td>
<td>1/50,000 ft&lt;sup&gt;2&lt;/sup&gt;</td>
<td>9.66 (2 x 10&lt;sup&gt;−5&lt;/sup&gt;)</td>
</tr>
<tr>
<td>Thickness, mil (mm)</td>
<td>ASTM D 5199</td>
<td>1/50,000 ft&lt;sup&gt;2&lt;/sup&gt;</td>
<td>200 (5)</td>
</tr>
<tr>
<td>Density, g/cm&lt;sup&gt;e&lt;/sup&gt;</td>
<td>ASTM D 1305</td>
<td>1/50,000 ft&lt;sup&gt;2&lt;/sup&gt;</td>
<td>0.94</td>
</tr>
<tr>
<td>Tensile Strength (MD), lb/in (N/mm)</td>
<td>ASTM D 5035</td>
<td>1/50,000 ft&lt;sup&gt;2&lt;/sup&gt;</td>
<td>45 (7.9)</td>
</tr>
<tr>
<td>Carbon Black Content, %</td>
<td>ASTM D 1603</td>
<td>1/50,000 ft&lt;sup&gt;2&lt;/sup&gt;</td>
<td>2.0</td>
</tr>
<tr>
<td>Geotextile (prior to lamination)&lt;sup&gt;f&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mass per Unit Area, oz/yd&lt;sup&gt;2&lt;/sup&gt; (g/m&lt;sup&gt;2&lt;/sup&gt;)</td>
<td>ASTM D 5261</td>
<td>1/90,000 ft&lt;sup&gt;2&lt;/sup&gt;</td>
<td>6 (200)</td>
</tr>
<tr>
<td>Grab Tensile, lb (N)</td>
<td>ASTM D 4632</td>
<td>1/90,000 ft&lt;sup&gt;2&lt;/sup&gt;</td>
<td>170 (755)</td>
</tr>
<tr>
<td>Puncture Strength, lb (N)</td>
<td>ASTM D 4833</td>
<td>1/90,000 ft&lt;sup&gt;2&lt;/sup&gt;</td>
<td>90 (395)</td>
</tr>
<tr>
<td>AOS, US sieve (mm)</td>
<td>ASTM D 4751</td>
<td>1/540,000 ft&lt;sup&gt;2&lt;/sup&gt;</td>
<td>70 (0.212)</td>
</tr>
<tr>
<td>Permittivity, sec&lt;sup&gt;e&lt;/sup&gt;</td>
<td>ASTM D 4491</td>
<td>1/540,000 ft&lt;sup&gt;2&lt;/sup&gt;</td>
<td>1.5</td>
</tr>
<tr>
<td>Flow Rate, gpm/ft&lt;sup&gt;2&lt;/sup&gt; (lpm/m&lt;sup&gt;2&lt;/sup&gt;)</td>
<td>ASTM D 4491</td>
<td>1/540,000 ft&lt;sup&gt;2&lt;/sup&gt;</td>
<td>110 (4,480)</td>
</tr>
<tr>
<td>UV Resistance, % retained</td>
<td>ASTM D 4355 (after 500 hours)</td>
<td>once per formulation</td>
<td>70</td>
</tr>
</tbody>
</table>

**NOTES:**
- <sup>a</sup>These are MARV values that are based on the cumulative results of specimens tested and determined by GSE. AOS in mm is a maximum average roll value.
- <sup>b</sup>Gradient of 0.1, normal load of 10,000 psf, water at 70° F between steel plates for 15 minutes.
- <sup>c</sup>Roll widths and lengths have a tolerance of ±1%.
- <sup>d</sup>Component properties prior to lamination.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

A. The geocomposite shall be installed in accordance with the Manufacturer’s recommended procedures.

B. The CQA Monitor shall verify that all geocomposite rolls and underlying layers are free from deleterious material or debris prior to deployment.

C. The geocomposite panels shall be positioned to minimize wrinkles.

D. No personnel working on the geocomposite shall smoke, wear damaging shoes, or engage in other activities that could damage the geocomposite. No equipment or tools shall damage the geocomposite by handling, trafficking, or other means.

E. The Contractor is responsible for anchoring exposed geocomposite to protect against wind damage until subsequent layers are placed.
F. The geocomposite shall only be cut utilizing methods and tools (i.e., a hooked utility blade) which will not damage the geocomposite or other previous work.

G. Each component of the geocomposite will be secured or seamed to the like component at overlaps.

H. Geocomposite components
1. Adjacent edges of the geonet along the length of the geocomposite roll shall be placed with the edges of each geonet butted against each other.
2. The overlaps shall be joined by tying the geonet structure with cable ties. These ties shall be spaced every five (5) feet along the roll length.
3. Adjoining geocomposite rolls (end to end) across the roll width should be shingled down in the direction of the slope, with the geonet portion on the top overlapping the geonet portion of the bottom geocomposite a minimum of 12-inches across the roll width. The geonet portion on end-to-end seams shall be tied every 6 inches.

I. During placement of geocomposite, care shall be taken not to entrap stones, excessive dust, or moisture that could damage the underlying or overlying geosynthetics, or cause clogging of drains or filters.

J. Following the installation of all geocomposite, an examination of the entire surface shall be conducted to detect potentially harmful foreign objects. Any such foreign objects found shall be removed or the panel shall be replaced by the Contractor.

K. The Contractor shall be responsible for field handling, storing, deploying, seaming, or joining, temporary restraining (against wind), anchoring, and other aspects of geocomposite installation.

L. The Contractor shall accept and retain full responsibility for all materials and installation and shall be held responsible for any defects in the completed systems.

3.2 FIELD QUALITY CONTROL

A. Field inspection and testing shall be performed in accordance with the CQA plan and as indicated in the Contract Documents. The GEOSYNTHETICS INSTALLER shall designate a full-time QC technician who shall be responsible for supervising and/or conducting the field QC program. The QC technician may not be replaced without written authorization by the Manager.

3.3 PROTECTION

A. The Contractor shall place all soil materials in such a manner as to ensure that:
1. The geocomposite and underlying materials are not damaged
2. Minimal slippage occurs between the geocomposite and the underlying geosynthetic layers
3. Excess tensile stresses are not developed in the geocomposite, such as by earth moving equipment making sudden sharp starts, stops, or turns. The
allowable ground pressure for equipment shall be prescribed by CQA MANAGER for the material type and layer thickness

4. Minimal movement and wrinkling or folding of the underlying geosynthetic layer occurs

3.4 REPAIRS

A. Any defects observed in the geocomposite shall be brought to the attention of the CQA MANAGER.

B. Any defects in the geocomposite shall be repaired per the Manufacturer’s specifications as approved by the CQA MANAGER.

C. Holes or tears in the geocomposite shall be removed and patched. The patch shall be secured to the original geonet by tying every 6 inches with the approved tying devices. If the area to be repaired is more than 50 percent of the width of the panel, the damaged area shall be cut out and the two portions of the geonet shall be cut out and the two portions of the geonet shall be joined in accordance with end-to-end seaming.

** END OF SECTION **
PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope
1. This section describes the general requirements for the manufacture, supply, installation, and quality control of the geosynthetic clay liner (GCL) associated with the Work.
2. The GCL will be procured directly by the OWNER from the GEOSYNTHETICS MANUFACTURER. The CONTRACTOR shall be responsible for unloading and storing the GCL prior to installation. All GCL shall be installed by the GEOSYNTHETICS INSTALLER.

B. Related Sections
1. Section 31 05 19.13 Geotextiles for Earthwork
2. Section 31 05 19.16 Geomembranes for Earthwork
3. Section 31 23 00 Excavation and Fill

1.2 REFERENCES

A. Latest Version of American Society for Testing and Materials (ASTM) standards:
1. ASTM D 4632 Standard Test Method for Breaking Load and Elongation of Geotextiles (Grab Method)
2. ASTM D 5084 Standard Test Method of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
3. ASTM D 5261 Standard Test Method for Measuring Mass Per Unit Area of Geotextiles
4. ASTM D 6243 Determining the Internal & Interface Shear Strength of Geosynthetic Clay Liner by the Direct Shear Method
5. ASTM D 5887 Standard Test Method for Measurement of Index Flux Through Saturated GCL Specimens Using a Flexible Wall Permeameter
6. ASTM D 5888 Standard Guide for Storage and Handling of GCLs
9. ASTM D 5993 Standard Test Method for Mass Per Unit Area of GCLs
10. ASTM D 6072 Standard Guide for Installation of GCLs

B. GRI GCL-3 Standard Test Method for GCL Overlap Seam Permeability

1.3 PRE-QUALIFICATION

A. The GEOSYNTHETICS INSTALLER shall pre-qualify for geosynthetic installation by providing the following qualification documentation:
1. The GEOSYNTHETICS INSTALLER shall have a minimum of 10,000,000 square feet (sf) of HDPE geosynthetic cumulative installation experience.
2. The GEOSYNTHETICS INSTALLER shall provide at least three references from prior installation projects in excess of 500,000 sf including the following information:
   a. Client’s name, address, phone number and contact or representatives name.
   b. Project site and description.
   c. Geosynthetic type(s) and quantity installed.

1.4 SUBMITTALS

A. GEOSYNTHETICS MANUFACTURER shall submit to the CQA MANAGER the following information relating to the GCL a minimum of fourteen (14) calendar days prior to shipment to the site:
   1. Quality Control Program:
      a. Certificates issued by the raw material supplier including the production dates of the raw material used to manufacture the geosynthetic clay liner.
      b. Certificates for each shift’s production of GCL, and statements of production dates.
      c. The quality control certificates shall include:
         i. Roll numbers and identification;
         ii. Sampling procedures; and
         iii. Results of quality control tests, including descriptions of the test methods used.
      d. The results of the manufacturing quality control tests shall meet or exceed the property values listed in Table 31 05 19.23-1.

B. Prior to mobilization of the GEOSYNTHETICS INSTALLER to the Site, the GEOSYNTHETICS INSTALLER shall submit the following:
   1. Shop drawings indicating panel layout and field seams. Each panel shall be assigned an identification number.
   2. Installation schedule.
   3. Copy of GEOSYNTHETICS INSTALLER letter of approval or license by the GEOSYNTHETICS MANUFACTURER.
   4. Proposed installation capabilities, including:
      a. Information on equipment proposed for this project;
      b. Average daily production anticipated for this project; and
      c. Quality control procedures.
   5. Resume of the superintendent and Quality Control Inspector for GEOSYNTHETICS INSTALLER to be assigned to this project, including dates and duration of employment. Substitution of these key personnel, without prior notification and approval by CQA MANAGER will be sufficient grounds for removal of GEOSYNTHETICS INSTALLER from the Project.
   6. Resumes of all GEOSYNTHETICS INSTALLER personnel who will perform seaming operations on this project, including dates and duration of employment.

C. Immediately upon Notice of Award, CONTRACTOR shall make available to the CQA MANAGER samples of the GCL for interface shear testing and conformance testing.
D. During the installation, the GEOSYNTHETICS INSTALLER shall be responsible for
the timely submission to the CQA MANAGER of subgrade acceptance certificates,
signed by the GEOSYNTHETICS INSTALLER and CONTRACTOR, for each area to
be covered by geosynthetic clay liner and geomembrane.

1.5 QUALITY ASSURANCE

A. All Work shall be constructed, monitored, and tested in accordance with the CQA
Manual. The CONTRACTOR, GEOSYNTHETICS INSTALLER and
GEOSYNTHETICS MANUFACTURER shall participate and comply with all items in
the CQA Manual.

B. GEOSYNTHETICS INSTALLER shall attend a pre-installation conference.
Attendance of parties directly affecting the WORK of this Section will be mandatory.

C. Conformance Testing
1. Material shall be made available to the CQA MANAGER after notice to
proceed for sampling and conformance testing by the CQA MANAGER at a
minimum frequency of one per 100,000 sf of geosynthetic clay liner
continuously produced and supplied to the project with a minimum of one
sample per lot.
2. If a test result is in non-conformance with the Specifications, all material from
that production lot represented by the failed test shall be rejected. Rejected
material may be minimized by bounding the non-conformance material with
additional passing tests conducted by the geosynthetic CQA laboratory.
Additional tests and replaced material will be provided at no additional cost
to the OWNER. No material shall be shipped until confirmation from the
CQA MANAGER that samples have passed conformance testing.

1.6 DELIVERY, STORAGE, AND HANDLING

A. CONTRACTOR and GEOSYNTHETICS INSTALLER shall conform to the
Manufacturer's requirements to prevent damage to GCL.

B. Transportation of GCL by the GEOSYNTHETICS MANUFACTURER shall be
through an independent trucking firm and shall be shipped via a closed or flatbed
trailer.

C. Offloading and storage of the GCL shall be the responsibility of the CONTRACTOR.
Handling and care of the GCL after acceptance by the CQA MANAGER, prior to and
following installation, will be the responsibility of the GEOSYNTHETICS
INSTALLER, until Final Acceptance of the liner system by the CQA MANAGER.

D. Delivery:
1. GEOSYNTHETICS MANUFACTURER shall deliver materials to the site only
after the CQA MANAGER approves the required submittals.
2. All rolls of GCL delivered to the site shall be identified by the
GEOSYNTHETICS MANUFACTURER at the factory with the following:
   a. Manufacturer's name
   b. Product identification
   c. Lot number
   d. Roll number
e. Roll dimensions

3. CQA MANAGER and CONTRACTOR must be present when GCL is delivered to the site. GEOSYNTHETICS MANUFACTURER shall notify CQA MANAGER a minimum of 2 business days prior to delivery.

4. CONTRACTOR is responsible for separating damaged rolls from undamaged rolls and storing at locations designated by the CQA MANAGER until proper disposition of material is determined by the OWNER and the CQA MANAGER.

5. The OWNER will be the final authority regarding damage.

6. CONTRACTOR shall separate rolls without proper documentation and store until the CQA MANAGER approval is received. Rolls or pallets without proper identification by GEOSYNTHETICS MANUFACTURER shall be subject to rejection.

E. On-site Storage:

1. CONTRACTOR shall store in space allocated by the OWNER.

2. Protect from puncture, dirt, grease, water, moisture, mud, mechanical abrasions, excessive heat or other damage.

3. Store on level prepared surface (not on wooden pallets).

4. Stack per Manufacturer’s recommendation but no more than three rolls high.

5. CONTRACTOR shall preserve integrity and readability of the GCL roll labels, and store such that CQA MANAGER shall have access to the package slips or roll labels for each roll to verify roll acceptance.

F. On-site Handling:

1. GEOSYNTHETICS INSTALLER shall use appropriate handling equipment to load, move or deploy GCL rolls. Appropriate handling equipment includes cloth chokers and spreader bar for loading, spreader and roll bars for deployment. Dragging panels on ground surface will not be permitted.

2. GEOSYNTHETICS INSTALLER shall not fold GCL material; folded material shall be rejected.

G. Damaged GCL:

1. GCL damage will be documented by the CQA MANAGER.

2. GCL found damaged upon arrival at the site shall be replaced by the GEOSYNTHETICS MANUFACTURER at no additional cost to the OWNER.

PART 2 - PRODUCTS

2.1 GEOSYNTHETIC CLAY LINER

A. The geosynthetic clay liner shall be GSE BentoLiner NWL, as manufactured by GSE Environmental, or ENGINEER-approved equal. The geosynthetic clay liner shall be formulated and manufactured from polypropylene geotextiles and high swelling, polymer-enhanced granular sodium bentonite.

B. Specifications for GCL properties are presented in Table 31 05 19.23-1 below. Supplied material shall conform to these properties based upon the Manufacturer’s QC testing and CQA conformance testing.
## TABLE 31 05 19.23-1
GCL PROPERTIES

<table>
<thead>
<tr>
<th>Property</th>
<th>Units</th>
<th>Test Method</th>
<th>Value</th>
<th>Minimum Manufacturer QC Test Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Geotextile Properties</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Cap Nonwoven, Mass/Unit Area</td>
<td>oz/yd²</td>
<td>ASTM D5261</td>
<td>6 (min. avg.)</td>
<td>25,000 yd²</td>
</tr>
<tr>
<td>2. Scrim Nonwoven, Mass/Unit Area</td>
<td>oz/yd²</td>
<td>ASTM D5261</td>
<td>6 (min. avg.)</td>
<td>25,000 yd²</td>
</tr>
<tr>
<td><strong>Bentonite Properties</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Swell Index</td>
<td>ml/2 g</td>
<td>ASTM D5890</td>
<td>24</td>
<td>50 tons</td>
</tr>
<tr>
<td>2. Fluid Loss</td>
<td>ml</td>
<td>ASTM D5891</td>
<td>18</td>
<td>50 tons</td>
</tr>
<tr>
<td><strong>Finished GCL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Bentonite, Mass/Unit Area¹</td>
<td>lb/ft²</td>
<td>ASTM D5993</td>
<td>0.75 (min avg.)</td>
<td>5,000 yd²</td>
</tr>
<tr>
<td>2. Tensile Strength²</td>
<td>lb/in</td>
<td>ASTM D6768</td>
<td>45 (min avg.)</td>
<td>25,000 yd²</td>
</tr>
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<td>3. Peel Strength</td>
<td>lb/in</td>
<td>ASTM D6496</td>
<td>3.5 (min avg.)</td>
<td>5,000 yd²</td>
</tr>
<tr>
<td>4. Hydraulic Conductivity³</td>
<td>cm/sec</td>
<td>ASTM D5887</td>
<td>5x10⁻⁹ (max.)</td>
<td>30,000 yd²</td>
</tr>
<tr>
<td>5. Index Flux</td>
<td>m³/m²/sec</td>
<td>ASTM D5887</td>
<td>1x10⁻⁸ (max.)</td>
<td>30,000 yd²</td>
</tr>
</tbody>
</table>

**Notes:**
1. At 0% moisture content.
2. Tested in machine direction.
3. Deaired, deionized water @ 5 psi maximum effective confining stress and 2 psi head pressure.

C. The GCL shall be manufactured by mechanically bonding the geotextiles using a needlepunching process to enhance frictional and internal shear strength characteristics. No glues or adhesives shall be used in lieu of the needlepunch process.

D. The needlepunched GCL shall thermally heat set the nonwoven fibers where they protrude from the second geotextile to more permanently secure the reinforcement in place. Other means may be used to lock the fibers in place if the process demonstrates similar performance to the thermal heat set process.

E. No disassociation of geotextile components from the bentonite core shall occur. A sample of the bentonite GCL placed in 70°F tap water for 1 hour shall not delaminate.

F. A minimum overlap guide-line and a construction match-line delineating the overlap zone shall be imprinted with non-toxic ink on both edges of the GCL panel to ensure the accuracy of the seam.

### PART 3 – EXECUTION

#### 3.1 SUBGRADE ACCEPTANCE

A. The GEOSYNTHETICS INSTALLER, on a daily basis, shall certify in writing that the surface on which the GCL will be installed is acceptable. It will be the CONTRACTOR’S responsibility to maintain, protect, and, if required, return the
subgrade in the condition that was originally accepted prior to GCL deployment until accepted by the CQA ENGINEER and GEOSYNTHETICS INSTALLER.

### 3.2 ANCHOR TRENCH

A. The CONTRACTOR shall excavate anchor trenches to the lines, grades, and widths shown on the drawings, prior to GCL placement. The CQA ENGINEER shall verify that the anchor trench has been constructed according to the Contract Drawings.

B. Slightly rounded corners shall be provided in the trench where the GCL adjoins the trench so as to avoid sharp bends in the GCL.

C. Care shall be taken when backfilling the trenches to prevent any damage to the GCL. At no time shall construction equipment come into direct contact with the GCL. If damage occurs, it shall be repaired by the Installer prior to the completion of backfilling.

D. Extend GCL into the anchor trench as shown in the Contract Drawings. The GCL shall be seamed along the entire distance of the anchor trench to the termination of the GCL panel, using approved methods described in this Section.

### 3.3 GCL DEPLOYMENT AND SEAMING

A. GCL panels shall be pulled from the roll suspended at the crest of the slope.

B. The GCL shall be overlapped in accordance with the GEOSYNTHETICS MANUFACTURER’s recommended procedures. As a minimum, the overlap shall be 12 inches along the length of the geosynthetic clay liner panel and 18 inches along the width of the geosynthetic clay liner panel on side slopes. As a minimum, the overlap shall be 6 inches along the length of the geosynthetic clay liner panel and 12 inches along the width of the geosynthetic clay liner panel on floor.

C. Displaced panels shall be adjusted to the correct position and orientation. The adjusted panel shall then be inspected for any geotextile damage or bentonite loss. Damage shall be repaired by the above procedure.

D. Place only as much GCL each day as can be covered with HDPE geomembrane liner. The GCL shall be covered by HDPE geomembrane liner at the end of each working day.

E. GCL shall be deployed so that panel seams are parallel to the dip of the slope.

F. Seams shall be perpendicular to toe of slope at all times.

G. Seams at the base of the slope shall be a minimum of 5 feet from the toe.

H. Seams shall be augmented with granular bentonite per the GEOSYNTHETICS MANUFACTURER’s recommendations to ensure seam integrity. Granular bentonite shall be dispersed evenly from the panel edge to the lap line at a minimum rate of ¼ pound per lineal foot continuously along all seams of overlap area. Accessory bentonite shall be of the same type of material used in the production of the geosynthetic clay liner itself.
I. In the event a roll end seam or joint cannot be avoided and occurs on a slope (>10%), construction adhesive shall be used in the lap area with the overlap increased to 24 inches in a rainflap (shingled) orientation.

J. Do not drag textured geomembranes across previously installed GCL. Use a smooth rub sheet between the GCL and the geomembrane, or other methods, to prevent damage. Remove rub sheet when geomembrane is in position.

K. The geosynthetic clay liner materials shall not be allowed to become wetted (except by the subgrade) prior to the placement of the geomembrane. All hydrated GCL shall be removed and replaced by the GEOSYNTHETICS INSTALLER at no additional cost to the OWNER.

L. For all penetrations in the geosynthetic clay liner, a small notch (approximately 3 inches wide and 8 inches deep) shall be cut along the edge of the area. The liner shall be brought up to the appurtenance and trimmed to fit into the notch. The GEOSYNTHETICS INSTALLER shall then hand apply pure bead of bentonite, or compact a mixture of 1 part bentonite to 4 parts soil (by volume), blended dry, into half of the notch. The liner shall then be inserted into the notch, with the remaining area in the notch refilled with the pure bentonite or the 1 to 4 mixture and compacted.

M. To avoid sharp bends in the geosynthetic clay liner, bevel the leading edges of the anchor trench.

3.4 GCL REPAIR

A. Prior to cover material placement, damage to the GCL shall be identified and repaired by the GEOSYNTHETICS INSTALLER. Damage is defined as any rips or tears in the geotextiles, delamination of geotextiles or a displaced panel.

B. Rips or tears may be repaired by completely exposing the affected area, removing all foreign objects or soil, and by then placing a patch cut from unused GCL over the damage (damaged material may be left in place), with a minimum overlap of 12 inches on all edges. Accessory bentonite should be placed between the patch edges and the repaired material at a rate of a quarter pound per lineal foot of edge spread in a continuous six inch fillet.

C. Damaged GCL material on slopes shall be repaired by the same procedures above, however, patch shall overlap the edges of the hole or tear by a minimum of 24 inches in all directions and the edges of the patch should also be adhered to the repaired liner with an adhesive to keep the patch in position during backfill or cover operations.

D. All repairs shall be made at no additional cost to the OWNER.

3.5 FIELD QUALITY CONTROL

A. Field inspection and testing shall be performed in accordance with the CQA MANUAL and as indicated in the Contract Documents. The GEOSYNTHETICS INSTALLER shall designate a full-time quality control (QC) technician who shall be
responsible for supervising and/or conducting the field quality control program. The QC technician may not be replaced without written authorization by the CQA MANAGER.

3.6 SURVEY CONTROL

A. CQA MANAGER will perform survey of final surface area of geosynthetics to determine quantities for payment purposes.

B. GEOSYNTHETICS INSTALLER shall provide CONTRACTOR and CQA MANAGER with record drawings of geomembrane panel locations and extent of the geomembrane. Drawings shall be submitted in both electronic and hardcopy format.

***END OF SECTION***
SECTION 31 23 00
EXCAVATION AND FILL

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals required to perform all site preparation, excavation, filling, and grading, and furnish all required soil materials, as shown in the Contract Drawings and/or as specified in this Section.
2. No classification of excavated materials will be made. Excavation shall include all materials regardless of type, character, composition, moisture, or condition thereof.

B. Related Sections
1. Section 31 05 19.13 Geotextiles for Earthwork
2. Section 31 05 19.16 Geomembranes for Earthwork
3. Section 31 05 19.23 Geosynthetic Clay Liners
4. Section 32 91 16 Planting Soil Stabilization

C. State of Wyoming Department of Transportation (WYDOT) Standard Specifications for Road and Bridge Construction, 2010 Edition

D. CQA Plan

1.2 REFERENCES

A. Latest Version of American Society for Testing and Materials (ASTM) standards:
1. ASTM D698 - Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
2. ASTM D2434 - Standard Test Method for Permeability of Granular Soils (Constant Head)

1.3 TERMINOLOGY

A. The following words or terms are not defined but, when used in this Section, have the following meaning:
1. “Subgrade” is the uppermost surface of native soil material unmoved from cuts or of placed fill.
1.4 SOURCE OF SUPPLY

A. The source for all Structural Fill material shall be the cell excavation. For bidding purposes, the CONTRACTOR may assume that sufficient quantities of Structural Fill, meeting the specified requirements, will be available for use from the on-site excavation.

B. Sand drainage layer, gravel material, Class W road base, and Class B bedding material (and bid alternate operations layer material) shall be sourced and imported by the CONTRACTOR from an approved off-site source.

1.5 SUBMITTALS

A. For each soil type specified in Part 2 of this Section, the CONTRACTOR shall submit laboratory data confirming the material meets project requirements a minimum of 14 days prior to starting construction. CONTRACTOR shall also be prepared to provide CQA MANAGER with 5-gallon pail samples of each of the proposed soils or authorization to access the proposed source for sampling.

Imported material shall not be shipped to the site until the submittal is approved by the CQA MANAGER.

B. The CONTRACTOR shall discuss with the CQA MANAGER the proposed methods and/or proposed equipment to be used for construction, including stripping, excavation, filling, moisture-conditioning, compaction, and backfilling for the various portions of the Work. The review shall be for method only. The CONTRACTOR shall remain responsible for the adequacy and safety of the methods.

1.6 CONSTRUCTION QUALITY ASSURANCE AND QUALITY CONTROL

A. All Work shall be constructed, monitored, and tested in accordance with the CQA Plan or as set forth by the CQA MANAGER.

B. All soil testing (both field and laboratory testing) shall be the responsibility of the CONTRACTOR (Quality Control) and/or the CQA MANAGER (Quality Assurance). The CONTRACTOR shall be responsible for cooperating with the CQA MANAGER during all testing activities. The CONTRACTOR shall provide equipment and labor to assist the CQA MANAGER in sampling, if requested, and they shall also provide access to all areas requiring testing activities.

C. CONTRACTOR shall retain the services of independent testing laboratory to perform testing and determine compliance with the materials specified in this Section and the CQA Plan.

D. CONTRACTOR shall be responsible for maintaining grade control throughout the Work.

E. All excavation, backfill, and grading operations shall be monitored by the CQA MANAGER.
F. Any Work found unsatisfactory or any Work disturbed by subsequent operations before acceptance is granted shall be corrected by the CONTRACTOR as directed by the CQA MANAGER at no additional cost to the OWNER.

1.7 TOLERANCES

A. Excavation limits are defined by the lines and grades shown in the Contract Drawings.

B. The tolerances for construction, unless otherwise approved by CQA MANAGER, shall be as follows:
   1. Slopes:
      a. Line: ± 0.2 feet
      b. Grade: ± 0.1 feet
   2. Floors:
      a. Line: ± 0.2 feet
      b. Grade: ± 0.1 feet

1.8 PROTECTION OF WORK

A. CONTRACTOR shall use all means necessary to protect all prior work and materials.

B. After fill materials have been placed, the CONTRACTOR shall maintain the surface free of ruts, depressions, and/or damage resulting from the hauling and handling of any material, equipment, tools, etc. In the event of damage, the CQA MANAGER will identify any areas requiring repair, and the CONTRACTOR shall make all repairs and replacements necessary to the satisfaction of the CQA MANAGER and at no additional cost to the OWNER.

C. Erosion control must be maintained. Erosion control measures shall be as specified in the Surface Water Pollution Prevention Plan (SWPPP).

D. CONTRACTOR shall protect benchmarks, survey markers, fences, roads, sidewalks, paving, curbs, and other existing structures from damage due to the CONTRACTOR’s activities.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Structural Fill shall consist of on-site soils derived from the excavation and/or other on-site borrow area that consist of relatively homogenous, well-graded natural soils that are free of debris, foreign objects, large rock fragments, roots and organic material. No materials larger than 3-inches shall be allowed. Structural fill materials shall be classified according to the Unified Soil Classification System (USCS) as either SP, SW, SM, or SC material.

B. Sand drainage layer material shall consist of medium to fine grained, uniformly graded, subrounded sand with a permeability equal to or greater than $1 \times 10^{-2}$ cm/sec.
C. Bid alternate operations layer material shall consist of earthen material with a permeability equal to or greater than $1 \times 10^{-3}$ cm/sec.

D. LCRS gravel material shall consist of a washed, uniformly-graded mixture of crushed stone or uncrushed gravel, with 100 percent passing the 1.5-inch sieve, and not more than five percent passing the No. 4 sieve. The material shall be free of debris, foreign objects, large rock fragments, and other deleterious matter. The gravel material shall exhibit a permeability of no less than 1 cm/sec and have a calcium carbonate content of less than 15%.

E. Aggregate road base material shall consist of Class W grading base course material that meets the requirements of Section 803.4.3 of WYDOT Standard Specifications.

F. Pipe bedding material shall be Class B Bedding that meets the requirements of Section 803.11 of the WYDOT Standard Specifications.

G. Any material which is found to be unsuitable for construction by the CQA MANAGER shall be removed from the work area by the CONTRACTOR at no additional cost to the OWNER.

PART 3 – EXECUTION

3.1 SITE PREPARATION

A. The CONTRACTOR shall develop access to the construction area(s) as necessary and in consideration of Article 1.8 of this Section.

B. CONTRACTOR shall contact utility companies and locate, mark out, and protect all existing utilities (including overhead utilities) before commencement of the Work.

C. CONTRACTOR shall contact utility companies and locate, mark out, and protect all existing utilities before commencement of the Work.

D. CONTRACTOR shall coordinate traffic control and barricades with OWNER and maintain OWNER’s access to site throughout the Work.

3.2 CLEARING AND GRUBBING

A. If required, clearing shall be done within the footprint of the limits of the construction area(s), as delineated in the Contract Drawings. Clearing shall extend a maximum of 15 feet and a minimum of 10 feet outside of the construction limits, or as directed by CQA MANAGER.

B. No clearing shall be performed until written permission is given by the OWNER, and until construction staking has been provided for the proposed Work.

C. CONTRACTOR shall strip all vegetative matter, rubbish, roots in excess of 1-inch diameter, and other deleterious materials from the designated area(s). In no case shall unsuitable deleterious materials, as determined by CQA MANAGER, be incorporated into Structural Fill materials.
D. In areas designated to be stripped of unsuitable or objectionable materials, said materials shall be stripped to the full depth of organic or other unsuitable material as determined by the CQA MANAGER.

E. Stripped and grubbed vegetation shall be removed and disposed in stockpiles or wasted by way of other approved methods in an area designated by OWNER in accordance with permits obtained from the appropriate local, state, and federal regulatory agencies.

### 3.2 TOPSOIL REMOVAL

A. Topsoil shall be stripped to a minimum depth of 6 inches, or as approved by CQA MANAGER, where required.

B. Topsoil shall be excavated and removed in a manner that will minimize contamination with other soil horizons. Such measures as are necessary shall be taken to ensure that the removal of topsoil does not result in erosion or excessive sedimentation as described in the CONTRACTOR’S SWPPP.

C. Removed topsoil shall be stockpiled at locations designated by OWNER. Stored topsoil shall not be disturbed by construction or on-site activities, and shall be protected from wind and water erosion, unnecessary compaction, and contamination that would lessen the capability of the material to support vegetation when redistributed.

D. Topsoil stockpiles shall be graded to minimize erosion and prevent ponding of precipitation in the stockpile areas. Stockpiled topsoil shall be protected by an effective temporary re-vegetation, as specified in Section 32 91 16, Planting Soil Stabilization.

E. Stockpiled topsoil shall not be moved until required for redistribution on a regraded area.

### 3.3 EXCAVATION

A. Excavation shall be performed to the lines and grades indicated in the DRAWINGS. No excavation shall begin until the CONTRACTOR has provided construction staking for the proposed work.

B. CONTRACTOR shall minimize the disturbance to surrounding areas during excavation.

C. Work shall be suspended by CONTRACTOR when, in the opinion of the CQA MANAGER, the site is overly wet, muddy, or otherwise unsuitable for proper maintenance, until directed otherwise by CQA MANAGER.

D. Where the required lines, levels and grades are not otherwise defined (such as where the excavation is anchor trenches or to assist with in tie-in with existing liner), CONTRACTOR shall excavate, as necessary, for the items that are to be placed in the excavations and as necessary to provide working space to install and inspect those items.
E. All necessary precautions shall be taken to preserve the material below and beyond the lines of excavation in the soundest possible condition. Where required to complete the Work, all excess excavation or over-excavation shall be refilled with approved Structural Fill materials placed and compacted to the satisfaction of the CQA MANAGER.

F. Safe temporary construction slopes shall be the responsibility of CONTRACTOR. CONTRACTOR shall inspect all temporary and permanent open-cut excavations on a regular basis for signs of instability. Should signs of instability be noted, CONTRACTOR shall immediately undertake remedial measures and shall notify CQA MANAGER immediately. Permanent cut slopes shall be left in smooth, safe, and stable condition at the end of the workday.

G. All materials excavated shall either be placed in stockpiles to be used as Structural Fill material or hauled to the designated waste spoil stockpile area. During excavation, grades shall be maintained to provide drainage of any surface waters that may impact the WORK.

3.4 UNAUTHORIZED EXCAVATION

A. All excavations outside lines and grades shown or indicated and that are not approved by the OWNER, together with removing and disposing of the associated material, shall be at CONTRACTOR's expense. Unauthorized excavations shall be filled and properly-compacted with Structural Fill material at CONTRACTOR’s expense.

3.5 STOCKPILE CONSTRUCTION

A. Stockpiles shall have side slopes no steeper than 4H:1V and shall not exceed a maximum elevation of El. 6680. The stockpiles shall be graded to drain, sealed by tracking parallel to the slope with a dozer or other means, and dressed daily during periods with fill is taken from the stockpile. The CONTRACTOR shall cover stockpiles with plastic sheeting or other temporary re-vegetation.

B. Surplus excavated soils shall be hauled and deposited in the designated waste stockpile spoil area. The waste stockpile spoil area shall be graded to drain to the northwest to promote positive drainage. No mechanical compaction is necessary.

C. Watering shall be performed during stockpiling to control dust.

3.6 SURFACE WATER CONTROL

A. CONTRACTOR shall construct surface water control features as shown in the Contract Drawings and/or as required to prevent significant erosion and sediment transport of stockpiles, excavation, and fill areas from storm water runoff.

B. The CONTRACTOR shall provide all equipment and facilities and perform all Work to make and keep work areas dry of surface water; construct the temporary sediment control systems; and improve the systems immediately if improvements are subsequently found to be necessary or prudent.
C. The CONTRACTOR shall prevent injury and damage due to dewatering, disposal of water, and sediment control.

D. The CONTRACTOR shall remove the temporary facilities when they are no longer necessary and restore the areas disturbed by dewatering and temporary sediment control.

E. The CONTRACTOR shall be liable for injury and damage resulting from failure to satisfactorily control sediment.

E. The CONTRACTOR is responsible for control of all surface water, as determined by OWNER or CQA MANAGER, for the orderly progress of the Work.

3.7 FINISH GRADING

A. CONTRACTOR shall uniformly grade the areas within limits of grading as indicated in the DRAWINGS, including adjacent transition areas, to a minimum 2% slope.

B. CONTRACTOR shall smooth subgrade surfaces within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.

3.8 SUBGRADE PREPARATION

A. The prepared subgrade shall be a minimum of 6 inches in thickness and be placed or excavated to the lines and grades as shown in the Contract Drawings and compacted to a minimum of 95% of the maximum dry density as measured according to ASTM D698 (Standard). The subgrade shall be moisture conditioned to achieve a uniform moisture content of ± 3 percent of optimum moisture. The dry unit weight and moisture content shall be measured in-place according to ASTM D2922 (Method B) and ASTM D3017 at the frequencies presented in the CQA Plan.

B. The prepared subgrade shall be free of loose materials, clods, rock and other debris including grade stakes and hubs and, where required, seal rolled with a smooth drum roller or by other CQA MANAGER approved method.

C. If excessive rutting or pumping (movements of more than 1 inch) is noted, as determined by CQA MANAGER, the subgrade at that location will be compacted or removed and replaced until deemed acceptable by the CQA MANAGER.

3.9 ANCHOR TRENCH EXCAVATION

A. The anchor trenches shall be excavated to the lines, grades, and widths shown in the Contract Drawings, prior to any geosynthetic material placement. CQA MANAGER shall verify that the anchor trench has been constructed according to the DRAWINGS.

B. The anchor trench shall be backfilled and compacted as approved by the CQA MANAGER. Trench backfill material shall be placed in 9 to 12 inch thick loose lifts and compacted by wheel rolling with light, rubber-tired or other light
compaction equipment, as approved by CQA MANAGER. Anchor trench backfill shall be moisture conditioned as required to achieve a moisture content of ± 3 percent of optimum moisture content as required by method specification as approved by CQA MANAGER.

C. Care shall be taken when backfilling the trenches to prevent any damage to the geosynthetic materials. At no time shall construction equipment come into direct contact with the geosynthetic materials. If damage occurs, it shall be repaired by the CONTRACTOR prior to the completion of backfilling, at no additional cost to the OWNER.

D. CONTRACTOR shall coordinate with GEOSYNTHETICS INSTALLER on the timing for anchor trench excavation, and assist the GEOSYNTHETICS INSTALLER with placing geosynthetic materials into the anchor trench as shown in the Contract Drawings and/or as required. The geosynthetic materials shall be seamed, bonded, or attached along the entire distance of the anchor trench by the GEOSYNTHETICS INSTALLER prior to backfilling the anchor trenches.

3.10 SAND DRAINAGE LAYER PLACEMENT

A. CONTRACTOR shall place leachate collection sand drainage layer in a single lift, as shown in the Contract Drawings. No mechanical compaction is necessary.

B. CONTRACTOR shall coordinate with GEOSYNTHETICS INSTALLER on the timing of sand drainage layer placement relative to geosynthetic liner installation.

C. A dozer with a ground pressure of less than 7 psi, or CQA MANAGER approved equivalent shall be used to spread the sand drainage layer over the geomembrane and shall operate only over previously placed sand drainage layer material. At no time will rubber tired vehicle traffic be allowed on the sand drainage layer.

D. The sand drainage layer shall be pushed up the side slopes in a single lift.

E. At all times, a minimum of 12 inches of sand drainage layer material shall be maintained between equipment and the geomembrane.

F. The CONTRACTOR shall not operate equipment directly over riser pipes or leachate collection pipes.

G. The CONTRACTOR shall take steps to minimize wrinkle size and generation in the geomembrane being covered. Placement hours and methods of protective cover soil operations may be restricted to prevent the development of wrinkles and stress bridging of the underlying geomembrane. CONTRACTOR must be prepared to adjust cover soil placement schedules so operations take place during cool temperature periods (e.g. early morning or night hours). CONTRACTOR shall provide adequate illumination if early morning or night hours are necessary to place cover soils. CONTRACTOR shall notify OWNER three days in advance of proposed schedule change for early morning or night hours placement operations.
H. Wrinkles that must unavoidably be buried should be divided into smaller wrinkles by ground personnel walking them out and approved by the CQA MANAGER. The wrinkles must be trapped in a near-vertical position by a ground-man as they are buried by sand, and in no case shall be greater than three (3) inches.

I. CONTRACTOR shall construct 36-inch thick haul roads, turnouts, staging and dump areas for all rubber-tired transport vehicles and loaders within the landfill cells. CONTRACTOR shall provide ground-man for each piece of placement equipment and not operate equipment without the presence of the ground-man.

J. CONTRACTOR shall expose by hand all locations where spinning tracks or tires may have damaged underlying geosynthetics, as directed by the CQA MANAGER.

3.11 LCRS GRAVEL PLACEMENT

A. CONTRACTOR shall place LCRS gravel around the leachate collection pipes and in sumps as shown in the Contract Drawings. LCRS gravel shall be underlain and covered by geotextile as shown in the Contract Drawings.

B. CONTRACTOR shall verify that HDPE piping and geotextile is installed prior to placement of gravel material.

C. CONTRACTOR shall ensure that HDPE piping is secured and not damaged by LCRS gravel placement.

3.12 SURVEY CONTROL

A. Surveying of the final location and elevation of the tops of the liner subgrade and the drainage layer and leachate collection piping will be performed by CQA MANAGER after placement of fill materials to verify quantities for payment purpose. Thicknesses will be verified by CQA MANAGER on a 50’ by 50’ grid.

***END OF SECTION***
SECTION 32 91 16
PLANTING SOIL STABILIZATION

PART 1 – GENERAL

1.1 DESCRIPTION

A. The CONTRACTOR shall furnish all labor, materials, tools, supervision, transportation, and installation equipment necessary to re-vegetate (drill, broadcast, or hydro-application) all areas identified in the Contract Drawings.

B. The CONTRACTOR shall review the installation procedures and coordinate the re-vegetation work with other site work.

1.2 REFERENCES

A. Federal Seed Act, amended August 1988, Wyoming Seed Law, 11-12-101 through 11-12-123, (Revised 2007), and Wyoming Weed and Pest Control Act of 1973

B. Association of Official Seed Analysts and International Seed Testing Association Guidelines


D. Test Methods for the Examination of Composting and Compost United States Composting Council (2002)

E. Colorado State University Cooperative Extension Service Fact Sheet No. 0.519 Managing Soil Compaction (2003)


1.3 SUBMITTALS

A. Material Certifications and Test Results (test results shall be no more than six months old from the date of delivery):
   1. Commonly accepted and scientific names of the kind and variety of the seed;
   2. The source/origin of the seed;
   3. Lot number or other lot identification and expiration date;
   4. The percentage of pure live seed, crop seed, inert matter, common weed seed, and hard seed by weight;
   5. Seed germination test results for warm and cold germination; and
   6. Name and number of restricted noxious weed seeds per pound.
B. For hydromulch applications, proposed application rate of seed, type of mulch and tackig agent, and type of hydraulic seeding equipment and nozzles proposed for use.

PART 2: PRODUCTS

2.1 MATERIALS

A. Seed Mix

1. Provide seed for grass in accordance with Table 32 91 16-1:

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Variety</th>
<th>PLS/sq ft</th>
<th>lbs PLS/Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Agropyron dasystachyum</em> (Elymus lanceolatus ssp lanceolatus)</td>
<td>Thickspike Wheatgrass</td>
<td>Critana</td>
<td>15</td>
<td>4.10</td>
</tr>
<tr>
<td><em>Agropyron trachycaulum</em> (Elymus trachycaulus)</td>
<td>Slender Wheatgrass</td>
<td>Revenue</td>
<td>6</td>
<td>1.74</td>
</tr>
<tr>
<td><em>Calamovilfa longifolia</em></td>
<td>Prairie sandreed</td>
<td>Goshen</td>
<td>15</td>
<td>2.39</td>
</tr>
<tr>
<td><em>Oryzopsis hymenoides</em></td>
<td>Indian ricegrass</td>
<td>Nezpar</td>
<td>15</td>
<td>4.08</td>
</tr>
<tr>
<td><em>Stipa comata</em></td>
<td>Needle-and-thread No Variety</td>
<td>6</td>
<td>2.27</td>
<td></td>
</tr>
</tbody>
</table>

**Total** 57 14.58

*Notes:*

\*PLS = pure live seed – bulk seed * % purity * % germination

2. Test seed for the following:
   a. **Purity and Germination:** Provide retesting results from the Supplier if seed was stored more than 6 months from the date of the Supplier’s original acceptance test.
   b. **Prohibited Noxious Weed Seed:** Seed shall contain no federal- or state-listed prohibited noxious weed seed as specified in the Wyoming Seed Law.
   c. **Restricted Noxious Weed or Regulated Weed Seed:** Seed shall contain no more noxious seeds per pound of any single restricted weed species than the amount established by the Wyoming Department of Agriculture as specified by Wyoming Seed Law.
   d. **Regulated Weed Seed:** Seed shall contain no more than 1 percent by weight of weed seed of other crops and plant species.

3. Test seed in accordance with guidelines established by the Association of Official Seed Analysts, International Seed Testing Association, and the Federal Seed Act standards. Test results shall be no more than six months old from the date of delivery to the worksite.

4. Test results shall be included on the label and/or certificate for each container of seed delivered to the worksite. In accordance with Wyoming
Seed Law section 11-12-105, seed supplier shall affix this label to the sealed container and include the following information:

a. Commonly accepted name of the kind and variety of the seed;
b. The full name and address of the person selling, offering or transporting the seeds for sale;
c. The percentage of pure seed, crop seed (not to be added to pure seed), inert matter, common weed seeds by weight, germination, hard seed and the month and year of the germination test;
d. The origin of the seed;
e. Lot number or other lot identification;
f. Name and number of each kind of restricted noxious weed seeds per pound; and
g. The words “poisonous treated” shall appear in bold print if the seeds have been treated with chemicals which are toxic or poisonous to either humans or livestock.

5. If a native variety is supplied as a substitute for the varieties specified in Table 32 91 16-1, seed shall be collected from a source within a 400-mile radius of the Worksite, with a similar annual precipitation and a similar elevation, or be adapted to the local climate. Sources for native seed variety shall be subject to inspection and acceptance by the CQA MANAGER.

6. CQA MANAGER may send seed to an independent testing laboratory to verify seed quality.

7. Seed mixture will require seed box separation. Provide the species composition for each seed box.

B. Straw or Hay Mulch

1. Mulch shall not be brittle, molded, or rotted, and shall be free of cattails and weed seeds of all plants on the Designated Noxious Weed List and the Prohibited Noxious Weed List as stated by the Wyoming Weed and Pest Control Act and Wyoming Seed Act, respectively.

2. If mulch is harvested outside of Wyoming, the CQA MANAGER may accept the mulch if there is no evidence of weeds listed on the Wyoming Designated Noxious Weed and Prohibited Noxious Weed lists. The CQA MANAGER will review the weed-free mulch certification, inspect the mulch upon delivery, and may perform periodic inspections of the mulch during application. If the CQA MANAGER determines that the mulch contains weeds listed on either list, mulch application will be stopped. The CQA MANAGER will reject the bale being applied and may reject associated bales prior to application.

3. Mulch shall be accompanied by documentation that the mulch has been inspected by the designated authority for certifying weed-free forage in the state from which it was obtained. The transit certificate shall match the weed-free certification certificate.

4. Mulch shall be in air-dry condition and suitable for placing with mulch application equipment.

5. Mulch shall be delivered in large, round bales that provide longer fibers. Large square bales may be accepted. Small square bales shall not be accepted.

6. CQA MANAGER will perform inspections of mulch upon delivery to ensure mulch is in suitable condition for use.

7. Provide native grass hay. Tall fescue ( Lolium arundinaceum or Festuca arundinacea) and Smooth Brome (Bromopsis inermis) are specifically
prohibited for use as grass hay mulch. Provide confirmation from the supplier that the product does not contain either of these species.

8. Provide certified weed-free hay. Weed-free straw mulch may be accepted by the CQA MANAGER if supplies of hay are limited due to environmental conditions, such as drought or disease.

C. Hydromulch
   1. Cellulose Fiber Mulch shall be natural cellulose fiber mulch produced from grinding clean whole wood chips.
   2. The mulch shall be designed for use in conventional mechanical planting, hydraulic planting of seed or hydraulic mulching of grass seed, either alone or with fertilizers and other additives.
   3. The mulch shall be such, that when applied, the material shall form a strong, moisture-retaining mat without the need of an asphalt binder.

3.0 PART 3: EXECUTION

3.1 MATERIAL PACKAGING, DELIVERY, AND INSPECTION

A. Deliver seed in sealed and labeled containers or rodent-proof bags in accordance with standard commercial practice.

B. Seed shall be free of mold and moisture. All labeling shall be intact and legible.

C. Deliver straw/hay mulch free of excessive mold and moisture.

D. Inspect all materials upon delivery to the worksite and prior to use. Ensure that materials meet the requirements of this Specification.

E. Remove any nonconforming materials from the worksite within 5 days at no expense to the OWNER.

3.2 SCHEDULING/SEQUENCING

A. Seeding Times:
   1. Fall seeding (preferred): Beginning October 1 (or after 4 consecutive days of average daily temp below 50° F) until freezing conditions (or as approved by the CQA MANAGER)
   2. Spring seeding: March 1 (or after soil thaws) – May 15 (or as approved by the CQA MANAGER)

B. Prior to the start of work activities, assess field conditions and ensure that soil and climate conditions are favorable to perform work activities.

3.3 SEED BED PREPARATION

A. After the designated areas have been rough graded or as provided for in other items of this contract and for any other soil area disturbed by the construction, a suitable seedbed shall be prepared. The seedbed shall consist of 6 inches salvaged topsoil

B. The topsoil shall be prepared so that compaction is appropriate for plant growth, and to achieve acceptable bulk density or hydrologic function. Rippers and subsoilers may be used to loosen compacted soil and roughen the surface. Disks,
plows and excavator attachments may be required for compaction reduction or roughening.

C. If tracked machinery is used in seedbed preparation, cleat marks should run with the contour to prevent rills.

D. Water shall be gently applied as required to prepare the seedbed prior to the planting operation either by broadcast seeding or hydraulic planting.

3.4 SEEDING

A. CONTRACTOR shall notify the CQA MANAGER at least 24 hours prior to the first time seeding is planned to allow for inspection of seeding equipment and calibration.

B. Do not commence seeding operations without seed bed preparation, seeding equipment, and authorization from the CQA MANAGER.

C. CONTRACTOR shall seed the final cover areas by mechanical (drill), broadcast, OR hydro-seeding.

D. Seed shall be applied within 10% (by weight) of the specified rate.

E. Mechanical (drill) seeding shall not exceed 6 inches between drill rows. Seeds shall be drilled to an average depth of 0.25 inch but not deeper than 0.5 inch.

F. Broadcast seeding shall be applied at double the drill seed rate. Broadcast seeding shall be followed by raking or harrowing of seed bed to an average depth of 0.25 inches but not deeper than 0.5 inch.

G. Hydro-seeding shall be applied at double the drill seed rate. Mulch may be applied with seed slurry. Slurry mix shall be applied in a motion to form a uniform mat at the specified rate.

H. CQA MANAGER will inspect the seeding activities to assure even and uniform application periodically for the duration of seeding activities.

3.5 MECHANICAL MULCHING AND ANCHORING

A. Place mulch in a continuous cover of uniform thickness at a rate of 2 tons per acre over the seeded area and as directed by the CQA MANAGER.

B. Apply mulch within 5 percent (by weight) of the rate specified.

C. Do not commence mulching and anchoring operations without seed application inspection, mulching equipment inspection, and authorization from the CQA MANAGER.

D. CQA MANAGER will inspect the mulch application activities periodically for the duration of mulch application activities.

E. Anchor mulch to the soil by crimping in a pattern (e.g., perpendicular to the slope on side slopes and perpendicular to prevailing wind direction on the flats). Crimp mulch within 24 hours of application, barring delays from inclement weather.
F. Crimp mulch into the soil to achieve rows of standing mulch; apply tackifiers for re-vegetation areas.

G. Do not sever the mulch during anchoring.

***END OF SECTION***
SECTION 33 01 12.13

ELECTRICAL CONTINUITY TESTING

PART 1 - GENERAL

1.1 SUMMARY

A. The CQA MANAGER will perform the geomembrane leak detection testing under separate contract with the OWNER. The CONTRACTOR shall provide support to the leak detection consultant as described within this Section.

B. The 60-mil HDPE geomembrane shall be surveyed using the dipole electrical leak location method (ASTM D7007) to detect for the presence of leaks due to damage to the geomembrane after the placement of the sand drainage layer (or geocomposite and operations layer), HDPE pipes, and LRCS drainage gravel.

C. The CQA MANAGER shall report the general results of the survey to the CONTRACTOR and OWNER during the daily progress of the field work.

D. CONTRACTOR shall render the geomembrane clean and uncluttered for CQA MANAGER for testing. Remove all standing water from the surface of the geomembrane and provide electrical isolation at the perimeter of the survey area.

1.2 REFERENCES

A. Latest Version of American Society for Testing and Materials (ASTM) standards:
   1. ASTM D7002, Standard Practice for Leak Location on Exposed Geomembranes Using the Water Puddle System.
   2. ASTM D7007, Electrical Methods for Locating Leaks in Geomembranes Covered with Water or Earthen Materials.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 SITE PREPARATION AND SUPPORT – DIPOLE SURVEY

A. The CONTRACTOR shall provide the CQA MANAGER with an updated project schedule for scheduling of the geoelectric leak location surveys a minimum of two (2) weeks prior to the preferred survey date. CONTRACTOR shall allow one (1) week for mobilization and completion of each survey.

B. During placement of sand drainage layer (or operations layer), soil placement shall end a minimum of 12 inches from the geomembrane limits to provide an electrical isolation between cover soils and the perimeter subgrade soils.
C. CONTRACTOR is responsible for preparing the survey area for the leak detection survey. The preparation consists of, but is not limited to, the following:

1. Provide water, water truck and driver, and wet the survey area prior to and during the dipole survey to ensure that there is adequate moisture in the material(s) covering the geomembrane for the dipole leak detection testing. To detect a leak, moisture must exist in the leak and be in contact with moisture in the materials above and below the liner. Therefore, the material(s) covering the geomembrane must be moistened with water prior to conducting the leak detection survey. In order to achieve uniform moisture distribution, the CONTRACTOR shall add water as the construction progresses on and within cover layer(s). A water truck must be available at all times as it may be necessary to wet the surface just in advance of the survey, as deemed necessary by the leak detection consultant.

2. The calibration process requires digging a hole down to the surface of the geomembrane to place the artificial leaks. The CONTRACTOR shall provide a backhoe and/or hand labor, as appropriate, to excavate the cover soils down to the geomembrane. The CONTRACTOR is also responsible for backfilling the calibration hole, and uncovering and retrieving the artificial leak apparatus, and backfilling the hole appropriately, including patching the geocomposite.

3. Several calibration exercises may be required, and the CONTRACTOR must be prepared to assist with each survey. In some cases an actual hole may be drilled for calibration, in which case the CONTRACTOR must be prepared to repair the calibration hole. If an actual hole is drilled, it is recommended to be performed after the artificial calibration is performed, and after an area has been surveyed so that the calibration hole does not interfere with the actual survey results.

4. The CONTRACTOR shall uncover, expose, and repair any leaks detected for repair in accordance with this Section.

3.3 LEAK REPAIRS

A. GEOSYNTHETICS INSTALLER shall repair all identified damage by the CQA MANAGER at no additional cost to the OWNER.

B. Following repair(s), the leak location survey shall be repeated on the two closest survey lines for a distance extending 20 feet before and beyond the leak. If another leak signal is detected, the entire repair and resurvey process shall be repeated until no additional leaks are detected.

C. The CQA MANAGER will mark the locations of all identified or indicated leaks with flags, sand bags, or spray paint. GEOSYNTHETICS INSTALLER shall survey the identified leak locations and identify the leak location son the HDPE geomembrane layout drawing with coordinates and then provide to the CQA MANAGER.

***END OF SECTION***
PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope
1. This section describes the general requirements for the manufacture, supply, and installation of the following high density polyethylene (HDPE) pipe and fittings:
   a. 6-inch diameter SDR 17 solid leachate collection riser pipe.
   b. 6-inch diameter SDR 17 perforated leachate collection pipe.
   c. 12-inch diameter SDR 17 solid secondary leak detection riser pipe.
   d. 12-inch diameter SDR 17 perforated secondary leak detection pipe.
   e. 18-inch diameter SDR 17 solid leachate collection riser pipe.
   f. 18-inch diameter SDR 17 perforated leachate collection pipe.
   g. 4-inch x 2-inch dual wall containment force main pipe.
2. The HDPE pipe will be procured by the CONTRACTOR. The CONTRACTOR shall be responsible for unloading, storing, and installing the pipe as specified.
3. The CONTRACTOR shall provide all labor, materials, equipment, and services required to place the HDPE pipe as shown in the Contract Drawings or as specified in this Section.

B. Related Sections
1. Section 31 05 19.13 Geotextiles for Earthwork
2. Section 31 05 19.16 Geomembranes for Earthwork
3. Section 31 05 19.23 Geosynthetic Clay Liners
4. Section 31 23 00 Excavation and Fill

1.2 REFERENCES

A. Latest version of American Society for Testing and Materials (ASTM) standards:
1. ASTM D1248 - Standard Specification for Polyethylene Plastics Molding and Extrusion Materials
2. ASTM D 1505 - Density of Plastics by the Density - Gradient Technique
4. ASTM D1693 - Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics
5. ASTM D2657 - Standard Practices for Heat-Joining for Polyolefin Pipe and Fittings
6. ASTM D2837 - Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials
7. ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Material
8. ASTM F714 - Standard Specification for Polyethylene (PE) Plastics Pipe (SDR-PR) Based on Outside Diameter
11. ASTM 1238 – Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
12. ASTM 3035 – Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter
14. ASTM F1248 – Determination of Environmental Stress Crack Resistance (ESCR) of Polyethylene Pipe
15. NSF 14 – Plastic Piping Components and Related Materials
16. PPI – Plastics Pipe Institute

B. CQA Manual

1.3 SUBMITTALS

A. CONTRACTOR shall submit detailed shop drawings of all HDPE pipe and fittings, a list of materials to be furnished, and the names of the suppliers. Submittals shall be made at least 7 days before the start of Work.

B. CONTRACTOR shall submit manufacturer’s quality control certificate for the HDPE pipe product showing the following:
   1. Certificate stating the specific resin, its source and information required by ASTM D1248.
   2. Certification that reclaimed material added to the resin does not exceed 2 percent by weight.
   3. Certification that the pipe meets the minimum physical property requirements.

C. Certifications of qualified HDPE pipe fusion welders that will be welding pipe during the project.

1.4 PIPE WELDERS QUALIFICATIONS

A. All operators fusion-welding pipe shall be certified by the manufacturer to be technically qualified and experienced in fusion welding of HDPE pipe.

B. Submit list of certified operators and certifications prior to pipe welding operations.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. The CQA MANAGER will inspect all pipe upon arrival at the site. Any damage or defects to the pipe per this inspection will be the responsibility of the CONTRACTOR. CONTRACTOR shall handle and store pipe and associated materials after such inspection in such a manner as to ensure a sound, undamaged condition. Procedures shall be in conformance with manufacturer’s recommendations.

B. Handling, storage, and care of the HDPE pipe and fittings prior to and following installation at the site, is the responsibility of the CONTRACTOR. The
CONTRACTOR shall be liable for all damage to the material incurred prior to final acceptance by the CQA MANAGER.

C. The CONTRACTOR shall be responsible for storage of HDPE pipe and fittings at the site. Pipe and fittings shall be stored on clean level ground, preferably turf or sand, free of sharp objects that could damage the pipe. Stacking shall be limited to a height that will not cause excessive deformation of the bottom layers of pipe under anticipated temperature conditions. Where necessary due to ground conditions, the pipe shall be stored on wooden sleepers, spaced suitably and of such width as not to allow deformation of the pipe at the point of contact with the sleeper or between supports.

PART 2 - PRODUCTS

2.1 HDPE MATERIALS

A. High Density Polyethylene (HDPE) resin – New first quality, compound and manufactured specifically for producing HHDPE pipe.

B. Specific gravity, as determined by ASTM D1505, shall be greater than 0.955 gm/cm³ and less than 0.96 gm/cm³.

C. Carbon black content, as determined by ASTM D1603, shall be at least 2.0 percent.

D. The polyethylene compound shall have a minimum resistance of 5000 hours when tested for environmental stress crack in accordance with requirements of GRI-GM5.

E. Manufactured in accordance with ASTM D3350 and ASTM D3261

F. Pipe resins listed with NSF and PPI. No mixing of different resin types during manufacturing.

G. No second run or recycled materials in manufacturing except for material generated in the manufacturer’s own plant and from the same raw material resin

H. Pressure rating of 100 psi.

I. Finished pipe free from cracks, holes (except perforation), bubbles, blisters, excessive gels, undispersed resins, undispersed carbon black, contamination by foreign materials, and nicks or cuts.

J. Meeting the minimum requirements specified in Table 33 46 16-1.
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<tr>
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<th>TEST METHOD</th>
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<td>III C5 P34</td>
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<td>Cell Classification</td>
<td>ASTM D3350</td>
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<td>Tensile Strength</td>
<td>ASTM D638</td>
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<td>Environmental Stress Crack</td>
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<td>Hydrostatic Design Basis</td>
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<td>Elastic Modulus</td>
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<td>Vicat Softening Temperature</td>
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<tr>
<td>Hardness</td>
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<td>64 Shore D</td>
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</tbody>
</table>

2.2 HDPE PIPE AND PIPE FITTINGS

A. High-density polyethylene (HDPE) resin. New, first quality, compounded, and manufactured specifically for producing HDPE pipe.

B. Manufactured in accordance with ASTM D3261 and ASTM D3350.

C. Pipe fittings resins listed with NSF and PPI. No mixing of different resin types during manufacturing.

D. No second run or recycled materials in manufacturing, except for material generated in the manufacturers own plant and from the same raw material resin.

E. Pressure rating of 100 psi.

F. Fully compatible with HDPE pipe.

G. Flange backup rings, bolts, nuts and washers at sump should be 316 stainless steel.

H. Provide flat neoprene gasket between all flanges and flange-adaptors.

PART 3 - EXECUTION

3.1 TRANSPORTATION

A. Transportation of HDPE pipe and fittings shall be the responsibility of the CONTRACTOR. The CONTRACTOR shall be liable for all damage to the pipe and fittings incurred prior to and during transportation to the site.
B. The CONTRACTOR shall ensure personnel responsible for unloading and storing materials on site are familiar with handling and transport constraints imposed by manufacturer and as required by this Section.

3.2 HANDLING AND PLACEMENT

A. Pipe and fittings shall be installed as indicated in the Contract Drawings.

B. The CONTRACTOR shall exercise care when transporting, handling and placing pipe and fittings, such that they will not be cut, kinked, twisted, or otherwise damaged.

C. The CONTRACTOR shall comply with the pipe manufacturer's recommendations for handling, storage, and installation of all pipe and fittings.

D. Ropes, fabric, or rubber-protected slings and straps shall be used when handling pipe. Slings, straps, etc. shall not be positioned at butt-fused joints. Chains, cables or hooks shall not be inserted into the pipe ends as a means of handling pipe.

E. Pipe or fittings shall not be dropped onto rocky or unprepared ground. Under no circumstances shall pipe or fittings be dropped or dragged over sharp objects.

F. The maximum allowable depth of cuts, gouges or scratches on the exterior surface of sideslope riser pipe or fittings is 10 percent of the wall thickness. The interior of the pipe and fittings shall be free of cuts, gouges and scratches. The CQA MANAGER will inspect all pipes. Sections of pipe with excessive cuts, gouges or scratches will be rejected and the CONTRACTOR will be required to remove and replace the rejected pipe, at no additional cost to the OWNER.

3.3 INSTALLATION

A. All pipe and fittings shall be installed in accordance with this Section and the pipe manufacturer's instructions.

B. The CONTRACTOR shall carefully examine all pipe and fittings for cracks, damage or defects before installation. Defective materials shall be immediately removed from the site and replaced with non-defective material at no additional cost to the OWNER.

C. The interior of all pipe and fittings shall be observed, and any foreign material shall be completely removed from the pipe interior by water flushing before the pipe is moved into final position.

D. Field-cutting of pipes, where required, shall be made with a machine specifically designed for cutting pipe. Cuts shall be carefully made, without damage to pipe or lining, so as to leave a smooth end at right angles to the axis of pipe. Cutter ends shall be tapered and sharp edges filed off smooth. Flame cutting will not be allowed.

E. All pipe and fittings shall be laid or placed to the grades and elevations shown with bedding and backfill as shown in the Contract Drawings.
F. Placement of overlying pipe protective soils shall be carried out such that no trafficking is allowed within 3 feet of any pipe.

G. No pipe shall be laid until the CQA MANAGER has observed the condition of the pipe.

H. No pipe shall be brought into position until the preceding length has been bedded and secured in its final position.

I. Blocking under piping shall not be permitted unless specifically accepted by the CQA MANAGER and the ENGINEER.

J. The CONTRACTOR shall provide all necessary adapters and/or connection pieces required when connecting different types and sizes of pipe or when connecting pipe made by different manufacturers.

K. When installing the pipes, the CONTRACTOR shall not damage the underlying geosynthetic materials. Any damage shall be repaired at no cost to the OWNER.

L. Bedding shall be placed beneath the pipe and conform to the pipe in order to provide continuous support along its entire length and to eliminate the formation of voids between the bedding and the pipe.

M. Endcaps shall be placed per manufacturer’s specifications on the ends of all leachate collection pipe headers where required and directed by CQA MANAGER.

N. The leachate collection piping shall be installed with the perforations facing the subgrade. Installed piping shall not be accepted with perforations on the upper portion of the pipes.

3.4 BUTT-FUSION WELDING

A. Welding operations will only take place when the ambient temperature is between 40°F and 110°F. Prevent water from coming in contact with pipe and heater plates during welding operations. Special weather welding plans must be submitted and approved by Design Engineer to weld outside this range.

B. In general, perform welding operations in compliance with these technical specifications and the manufacturer’s fusion welding manual.

C. Thermal butt or side-wall fusion weld all pipe in accordance with the manufacturer’s instructions. Use correct plate temperatures, fusion pressures and cycle times for the diameter of pipe being welded.

D. Use power source capable of producing sufficient and constant voltage to maintain constant heater plate surface temperatures.

E. Check surface temperature of heater plate and verify gauge readings with a pyrometer (high temperature thermometer).
F. Use power source capable of producing sufficient and constant voltage to maintain constant heater plate surface temperatures.

G. Clean inside and outside of pipe ends to remove dirt, water, grease, and other foreign material.

H. Squarely face pipe ends the facing tool of the fusion-welding machine. Remove all cuttings from inside of pipe.

I. Line up pipe ends in the fusion welding machine so that the pipe ends meet squarely and completely over the entire surface to be welded. Securely clamp pipe into place so that the pipe does not move during the fusion welding process.

J. Clean heater plate and verify appropriate heater plate temperature. Insert heater plate between the aligned pipe ends and firmly bring the pipe ends into contact with the heater plate.

K. Allow the pipe ends to heat and soften. As the pipe heats and softens a melt bead begins to roll back from the contact point of the heater plate and the pipe ends. Approximate diameter sizes of melt beads for various sizes of pipe are as follows:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Diameter of Melt Bead</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-inch to 12-inch</td>
<td>3/16-inch</td>
</tr>
<tr>
<td>12-inch to 22-inch</td>
<td>1/4-inch to 5/16-inch</td>
</tr>
</tbody>
</table>

L. Quickly and cleanly remove the heater plate when the appropriate melt bead is achieved. Verify that no melted pipe material sticks to the heater plate. If melted material sticks to the heater plate, discontinue this joint, clean the heater plate, re-face the pipe ends, and re-start the joint.

M. Rapidly join the melted pipe ends together and apply enough pressure to the joint to form a melt bead 1/8-inch to 3/16-inch in diameter around the entire circumference of the pipe. Pressure is critical to cause the heated material of each pipe end to flow together.

N. Allow the joint to cool and solidify properly before the pipe is released from the fusion-welding machine. Cooling and solidification is completed when the operator’s finger can remain comfortably on the bead or at approximately 110°F.

O. Examine the joint when the pipe is released from the fusion-welding machine to verify that the weld is completely around the entire circumference of the pipe.

P. Remove all cuttings, shavings, debris, and dirt from interior of installed pipe.

3.5 PRESSURE TESTING

A. Unless specified otherwise the following tests shall be performed as directed by CQA MANAGER:
   1. Exfiltration Testing on all gravity leachate piping, manholes, and other fabricated structures; and
   2. Hydrostatic Testing on all pressure leachate pipes and force mains.
B. The CQA Organization shall require exfiltration tests on all manholes and on gravity piping.

C. The section to be tested and the manner of test will be determined by the CQA MANAGER.

D. Procedure for Exfiltration Testing:
   1. Plug each end of section or all openings to manhole to be tested with watertight bulkheads.
   2. Insert in each bulkhead at the top of the pipeline a two (2") inch pipe with 90° elbow that will extend four (4’) feet vertically above the top of the pipeline or above the groundwater line, whichever is higher. Manholes shall be tested at full depth with the water level at the cover ring.
   3. The elevations of the top of the two (2") inch pipe at each bulkhead shall be the same.
   4. Fill the pipeline with clear water until the water level is at the top of the two (2") inch pipe at the upper end of section or at the manhole ring.
   5. Maintain the water level by adding accurately measured amounts of water for a period of thirty minutes, not allowing the lower pipe to overflow. The exfiltration test is to run for a minimum 24 hour period.

E. The maximum length of a section of pipeline to be tested by means of an exfiltration test at one time shall be limited to 1,000 linear feet.

F. The maximum permissible leakage determined by exfiltration shall be the rate of 25 gallons per inch interval diameter of pipe per mile of pipe line per 24 hours, inclusive of all appurtenances within the section such as manholes, etc. The length of pipe used in the computation shall be the horizontal distance between manhole centerlines of the section being tested. The maximum permissible leakage for manholes shall be 0.01 gallons per vertical foot per day.

G. Once infiltration is found to be within allowable limits, remove all bulkheads.

H. The following piping system shall be Hydrostatically tested:
   1. Leachate force mains; and all other pressure piping systems not specifically requiring testing under other Sections of this CQA Plan with the exception of piping systems where water testing will be harmful to the system operation, such as for air and gas piping systems.

I. After the pipe has been laid and backfilled between fittings, and before any fittings are covered, unless this requirement is waived by the CQA Organization, all newly laid pipe, above ground or below ground, or any valved section thereof, shall be subjected to a hydrostatic gauge pressure as hereinafter tabulated.
   1. All piping that will be considered inaccessible or impossible to repair after the completion of all work shall be hydrostatically tested while still accessible.
   2. Examples of such piping are those near or under basins, paved roads, concrete structures and concrete foundations.
   3. Note: All piping shall have reaction blocking (thrust blocks) in place before testing, as required.
J. Tests shall be under the direction of the CQA Organization.

K. The Contractor shall furnish a pressure gauge for measuring the pressure on the pipeline, shall provide a corporation cock to attach gauge or pump connection, and shall provide plugs to seal taps after use in testing, and shall also furnish a suitable pump, pipe, appliances, and other appurtenances necessary to make these tests.

L. The Planned test methods and repairs to test ports/taps shall be submitted to the Design Engineer for approval. Taps shall be made within manholes unless approved in advance by Design Engineer. Plugs used for sealing test ports are to be compatible with the required pipe test pressure and for exposure to leachate. Plugs are to be submitted to the Design Engineer for approval.

M. The following presents the required testing procedure:

1. Each section of pipe shall be filled slowly with water and the specified test pressure, measured at the point of lowest elevation, shall be applied to the pipe in a satisfactory manner. The Contractor will furnish all test water;

2. Before applying the specified water test pressure, all air shall be expelled from the pipe. To accomplish this, taps shall be made, as directed by the CQA Organization, if necessary, at points of highest elevation, and afterward tightly plugged;

3. The test pressure shall be maintained for a sufficient length of time prior to the test to allow for thorough examination of joints and elimination of leakage where necessary. The pipe line shall be made watertight under the test pressure.

4. All exposed pipes, fittings, valves, hydrants, and joints will be carefully examined during the open trench test. Any cracked or defective pipes, fittings, valves, or hydrants discovered in consequence of this pressure test shall be removed and replaced by the Contractor with sound material and the test shall be repeated until satisfactory to the CQA Organization;

5. Hydrostatic test pressures shall be as follows:

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<th>Pressure Test Rating (psi)</th>
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<td>Miscellaneous pressure pipe</td>
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<tr>
<td>Primary Pressure leachate</td>
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<tr>
<td>Secondary Containment Pipe</td>
<td>100</td>
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</table>

6. The test shall be conducted for a minimum of six (6) hours;

7. The tested section will not be accepted if it has any observed leakage or test pressure drops more than one (1) psi during the leakage test;

8. The CQA Organization shall provide detailed sketches of all leachate collection system fabrication; and

9. Weep holes/ drainage ports are to be opened in the secondary containment pipes within the manholes, as shown on the plans, following completion of pressure testing. The CQA Organization is to document the completion of drainage ports.
3.5 TOLERANCES

A. The CONTRACTOR shall be responsible for installing all HDPE piping within the following tolerances:
   1. Horizontal tolerance: ±0.2 ft. maximum
   2. Vertical tolerance: ±0.1 ft. maximum
   3. Maintain positive grades - no reverse slopes allowed at any location.

3.9 SURVEY CONTROL

A. The CONTRACTOR shall survey the location and final elevation of the inverts of all HDPE piping installed. The pipes shall be surveyed at their ends and at approximate 50-foot intervals between the ends.

B. The CONTRACTOR shall provide Record Drawings of the locations and elevations of the HDPE piping.

***END OF SECTION***
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## Section and Name

**DIVISION 00 – BIDDING AND CONTRACTING REQUIREMENTS**

**BIDDING REQUIREMENTS**

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<th>Section</th>
<th>Name</th>
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<tr>
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<td>Table of Contents</td>
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<tr>
<td>00 01 15</td>
<td>List of Drawings</td>
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**DIVISION 01 – GENERAL REQUIREMENTS**

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<td>Project Coordination</td>
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<td>01 35 29</td>
<td>Health, Safety, and Emergency Response Procedures</td>
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<td>01 40 00</td>
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**DIVISION 31 – EARTHWORK**

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<td>Geomembranes for Earthwork</td>
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<td>Geocomposites</td>
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<td>31 05 19.23</td>
<td>Geosynthetic Clay Liners</td>
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<td>31 23 00</td>
<td>Excavation and Fill</td>
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***END OF TABLE OF CONTENTS***
SECTION 00 01 15
LIST OF DRAWINGS

PART 1 – GENERAL

1.1 DESCRIPTION

A. This Section lists the Drawings for the Happy Jack Landfill Phase 2, Cells 1 and 2 Construction and Cell 3 Excavation Earthworks Project.

1.2 CONTRACT DRAWINGS

A. The Contract Drawings are as follows:
   1. Sheet 1 – Cover Sheet
   2. Sheet 2 – Existing Conditions
   3. Sheet 3 – Subgrade Plan
   4. Sheet 4 – Liner and Leachate Collection System Plan
   5. Sheet 5 – Leachate Force Main Plan and Profile (Sheet 1 of 2)
   6. Sheet 6 – Leachate Force Main Plan and Profile (Sheet 2 of 2)
   7. Sheet 7 – Liner Details
   8. Sheet 8 – Leachate Collection System Details (Sheet 1 of 2)
   9. Sheet 9 – Leachate Collection System Details (Sheet 2 of 2)
  10. Sheet 10 – Leachate Collection System P&ID
  11. Sheet 11 – Leachate Collection System Cell Discharge Pipe System Sections and Details
  12. Sheet 12 – Fence Details

1.3 PROJECT CONDITIONS

A. CONTRACTOR shall inform OWNER of any discrepancies, errors, or omissions discovered or in the Bidding Documents.

B. Where there are differences, as determined by the OWNER, between details and dimensions shown on the Contract Drawings and details and dimensions of existing features at the Site, CONTRACTOR shall use details and dimensions of existing features at the Site.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

***END OF SECTION***
### BASE BID UNIT PRICE SCHEDULE

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<td>Installation of GCL</td>
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**TOTAL BASE BID:**  

### BID ALTERNATE UNIT PRICE SCHEDULE

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SECTION 01 11 00

SUMMARY OF WORK

PART 1 – GENERAL

1.1 SUMMARY

A. The Work specified in this Contract consists of furnishing all management, supervision, labor, materials, tools, equipment, services, testing and incidentals for the completion of the Work as indicated in the Contract Documents.

B. The information presented in the Bidding Documents illustrates the best information available. Existing field conditions shall be field verified prior to performance of the Work.

1.2 PROJECT INFORMATION

A. Project Name: Happy Jack Landfill, Phase 2 Cells 1 And 2 Construction and Cell 3 Excavation, Geosynthetics Installer Project.

B. ENGINEER’s Project No.: 123-81971

C. Project Site (the Site): Happy Jack Landfill
   1461 Happy Jack Rd
   Cheyenne, WY 82009

D. OWNER: City of Cheyenne

E. ENGINEER: Golder Associates Inc.

F. OWNER’s REPRESENTATIVE: Solid Waste Professionals of Wyoming, LLC

G. CQA FIRM/MANAGER: Solid Waste Professionals of Wyoming, LLC

H. Contracting Method: The OWNER will contract the Work through the following three independently awarded Contracts:
   1. Earthworks
   2. Geosynthetic Procurement
   3. Geosynthetic Installer

   It shall be the responsibility of each Contractor to coordinate with the OWNER, the CQA MANAGER, and the other Contractors to ensure that the Work is scheduled and completed within the Contract Time(s).

   The GEOSYNTHETICS INSTALLER contract will not be executed until FY2022, which commences on July 1, 2021. It is the requirement of the Earthworks Contract that all excavation and grading work necessary for geosynthetic installation be completed by July 1, 2021.
Bidding: The Bid includes a Base Bid and a Bid Alternate. OWNER reserves the right to award Contract on the basis of Base Bid or in consideration of the Bid Alternate.

1.3 DEFINITIONS

A. Wherever used throughout the Specifications, the terms listed below have the meanings indicated:

1. CONTRACTOR – The individual or entity with whom the OWNER has entered into an Agreement for performance of the Earthwork components of the Work.
2. ENGINEER or CQA MANAGER – The entity who is to act as the OWNER’s representative and assume all duties and responsibilities and have the rights and authority assigned to the ENGINEER in the Contract Documents in connection with completion of the Work in accordance with the Contract Documents.
3. OWNER – The City of Cheyenne, Wyoming; owner of the project.
4. GEOSYNTHETICS MANUFACTURER – The individual or entity with whom the OWNER has entered into an Agreement for the procurement of the geosynthetic materials, independent of the earthwork and geosynthetic installation Contracts.
5. GEOSYNTHETICS INSTALLER - The individual or entity with whom the OWNER has entered into an Agreement for the installation of the geomembrane and GCL liners, independent of the earthwork and geosynthetic procurement Contracts.

1.4 DESCRIPTION OF WORK

A. The Work to be performed under this Earthworks Contract includes, but it not limited to, the following:

1. Installing geosynthetic clay liner (GCL);
2. Installing 60-mil HDPE double-sided textured geomembrane;
3. (Bid alternate installing geocomposite); and
4. Installing a pipe penetration and pipe boot to existing liner system for the leachate forcemain discharge to existing leachate collection pond.

It is not intended that this description of the Work encompass each particular item required, but rather that it give information concerning the general scope and areas of work for the convenience of the Bidders. Please see Section 01 22 13, Measurement and Payment for detailed descriptions of the Work and all unit price pay items.

B. GEOSYNTHETICS INSTALLER’s responsibilities as required by the Contract Documents include the following:

1. Be solely responsible for all means, methods, techniques, sequences, and procedures of geosynthetic installation.
2. Except as specifically noted, furnish all supervision, labor, materials, tools, supplies, machinery and equipment necessary for completion of the Work as described in the Contract Documents, Contract Drawings and Specifications.
3. Comply with codes, ordinances, rules, regulations, orders and other legal requirements of public authorities that bear on performance of the Work.
4. Furnish a competent and adequate staff, as necessary for the proper administration, coordination, supervision, and superintendence of the Work; organize the procurement of all materials and equipment so that they will be available at the time they are needed for the Work; and keep an adequate force of skilled workmen on the job to complete the Work in the best and soundest manner in accordance with the requirements of the Contract Documents and in the most expeditious and economical manner consistent with the interests of the OWNER.

5. Furnish any and all health and safety related items (including a Health & Safety Plan) that may be required in Section 01 35 29  Health, Safety, and Emergency Response Procedures.

6. Coordinate with CONTRACTOR on timing and requirements of geosynthetic installation and associated earthworks.

7. Render all necessary assistance and equipment to the OWNER AND CQA MANAGER for inspection of the Work. The GEOSYNTHETICS INSTALLER shall provide sufficient, safe and proper facilities at all times for the inspection of the Work by the OWNER and/or CQA MANAGER. The GEOSYNTHETICS INSTALLER shall provide sufficient advance notice for the OWNER and/or CQA MANAGER to inspect any portion of the Work.

8. Attend weekly progress meetings at the Site in accordance with Section 01 31 13  Project Coordination.

9. Provide containment and disposal of all crating and packaging materials, and remove all debris from the project area and dispose of in a legal manner.

10. Remove any defective work found to exist, whether the result of poor workmanship, use of defective materials, or damage through the GEOSYNTHETICS INSTALLER's carelessness, and immediately replace with work and materials which conform to the Specifications, or remedy in a manner authorized by the OWNER at the GEOSYNTHETICS INSTALLER's expense.

11. The GEOSYNTHETICS INSTALLER must give the ENGINEER and OWNER's REPRESENTATIVE written notice of all conflicts, errors or discrepancies that the GEOSYNTHETICS INSTALLER discovers in the Contract Documents and the written response thereof by the ENGINEER and/or OWNER's REPRESENTATIVE is acceptable to the GEOSYNTHETICS INSTALLER.

12. Submit a detailed schedule for construction within 10 days of Notice of Award to OWNER’s REPRESENTATIVE and ENGINEER.

1.5 OWNER RESPONSIBILITIES

A. OWNER will arrange for and deliver necessary electronic versions of Contract Drawings to CONTRACTOR for information and coordination of the Work and for installation.

B. OWNER will furnish the data required of OWNER under the Contract Documents.

C. OWNER will provide construction quality assurance (CQA) monitoring to observe and record construction.

D. The OWNER will not supervise, direct or have control or authority over, nor be responsible for, GEOSYNTHETICS INSTALLER's means, methods, techniques, sequences, or procedures of construction or the safety precautions and programs incident thereto, or for any failure of GEOSYNTHETICS INSTALLER to comply with Laws and Regulations applicable to the furnishing or performance of the work.
OWNER will not be responsible for GEOSYNTHETICS INSTALLER’s failure to perform or furnish the Work in accordance with the Contract Documents.

E. OWNER will furnish water for construction from an on-site water source.

1.6 WORK BY OTHERS

A. The OWNER will procure the geosynthetic materials directly from the GEOSYNTHETICS MANUFACTURER. This will include the 60-mil HDPE geomembrane (double-sided textured), the GCL, the 12 oz/sy and 16 oz/sy geotextile fabric (and the and bid alternate 200 mil geocomposite) for use in the Work.

The CONTRACTOR shall be responsible for unloading the materials at the site and for storing and protecting the materials prior to installation, as described in the Specifications.

B. All other materials required to complete the Work, other than those specifically identified in Article 1.6A of this Section, shall be furnished by the CONTRACTOR or GEOSYNTHETICS INSTALLER.

1.7 SEQUENCE AND PROGRESS OF WORK

A. Requirements for sequencing or scheduling the Work are discussed in Section 01 31 13 Project Coordination.

1.8 CONTRACTOR’S USE OF SITE

A. The CONTRACTOR shall coordinate with the OWNER to establish haul routes, right of way, schedule, traffic control, signage, etc.

B. GEOSYNTHETICS INSTALLER shall not enter or disturb portions of the site beyond the areas in which the WORK is located.

PART 2 – PRODUCTS

A. The GEOSYNTHETICS INSTALLER shall provide all labor, materials, tools, and equipment necessary for the completion of the Work as shown in the Contract Drawings or described in the Specifications.

PART 3 – EXECUTION

A. The GEOSYNTHETICS INSTALLER shall comply with all local, state, and federal laws and regulations. OWNER will not be liable for any fines, penalties, etc.

***END OF SECTION***
SECTION 01 22 13

MEASUREMENT AND PAYMENT

PART 1 – GENERAL

1.1 DESCRIPTION

A. This Section describes the administrative and procedural requirements for how Lump Sum and Unit Price pay items established in the Agreement will be measured and paid for when making progress and final payments.

B. Lump Sum and Unit Price pay items listed in this Section refer to and are the same pay items listed in the Bid Form and constitute all pay items for completing the Work in this Contract. Compensation for all services, items, materials, and equipment required to complete the Work shall be paid at the Lump Sums and Unit Prices included in the Contract.

C. All measurements and payments will be based on completed Work performed in strict accordance with the Contract Documents and in accordance with Contract Lump Sums and Unit Prices. Incidental Work and items not listed in the Contract Bid Form will not be paid separately but will be included in the payment for the listed item or items to which such incidental Work applies.

D. Lump Sums and Unit Prices shall include all direct and indirect costs, including GEOSYNTHETICS INSTALLER’s overhead and profit for each separately identified item.

E. The OWNER will provide the surveying required for the completion and measurement of the Work as specified in Section 01 71 23 Surveying.

1.2 ENGINEER’S ESTIMATE OF QUANTITIES

A. ENGINEER’s estimated quantities for Unit Price pay items, as listed in the Bid Form, are approximate only and are included solely for the purpose of comparison of Bids. OWNER does not expressly or by implication agree that the actual quantities of material encountered or required will correspond therewith and reserves the right to increase or decrease any quantity or to eliminate any quantity, as OWNER may deem necessary.

1.3 PAYMENT PROCEDURES

A. GEOSYNTHETICS INSTALLER shall submit Applications for Payment in accordance with Contract Requirements.

1.4 LUMP SUM BID ITEMS

A. Payment items for the Work of this Contract for which Contract Lump Sum payments will be made are listed in the Bid Form. All costs for items of Work which are not specifically mentioned to be included in a particular Lump Sum or Unit Price payment item shall be included in the listed Lump Sum item most closely associated with the Work involved. The Lump Sum price and payment made for each item listed
shall constitute full compensation for furnishing all labor, materials, and equipment, and performing any associated GEOSYNTHETICS INSTALLER quality control, environmental protection, meeting safety requirements, tests and reports, and for performing all Work required for which separate payment is not otherwise provided.

B. Contract Lump Sum is full compensation.

1.5 UNIT PRICE BID ITEMS

A. Payment items for the Work of this Contract on which the Contract Unit Price payments will be made are listed in the Bid Form. The Unit Price and payment made for each item listed shall constitute full compensation for furnishing all labor, materials, and equipment, and performing any associated GEOSYNTHETICS INSTALLER quality control, environmental protection, survey control, meeting safety requirements, tests, and reports, and for performing all Work required for each of the Unit Price items.

B. Contract Unit Price multiplied by agreed quantity is full compensation.

1.6 BID ITEMS

Item 1 – Mobilization/Demobilization

1. PAYMENT: Payment will be made for costs to mobilize and demobilize all labor, equipment, supplies, tools, parts, trailers, and other incidents required to perform the Work, including but not limited to insurance and bonding, site administration expenses, and site cleanup to the satisfaction of the OWNER.

2. UNIT OF MEASURE: Lump sum. Payment shall be made at the lump sum price, not to exceed ten percent (10%) of the total bid price, at the rate of 50 percent of the lump sum price with the first invoice and 50 percent following Substantial Completion of the Contract.

3. MEASUREMENT: There shall be no measurement for payment.

Item 2 – Installation of GCL

1. PAYMENT: Full compensation for all labor, materials, equipment, and other incidental costs necessary to unload from storage, haul to work area, and install GCL as shown in the Contract Drawings and discussed in the Specifications and CQA Manual, including but not limited to: subgrade maintenance, acceptance, and protection; protection of installed GCL; repair of damaged installed GCL as necessary; and field quality control. A GCL panel layout shall be provided prior to start of work. GEOSYNTHETICS INSTALLER shall also provide a Record Drawing showing panel number and seams. OWNER shall supply the GCL and accessory bentonite materials. GEOSYNTHETICS INSTALLER is responsible for unloading GCL from storage and hauling to work area.

2. UNIT OF MEASURE: Square footage of GCL installed.

3. MEASUREMENT: The total quantity of GCL for which payment shall be made shall be the square footage of GCL installed as determined by field surveys.
Item 3 - Installation of 60 mil HDPE Geomembrane (double-sided textured)

1. PAYMENT: Full compensation for all labor, materials, equipment, and other incidental costs necessary to unload from storage, haul to work area, and deploy and weld double-sided textured geomembrane as shown in the Contract Drawings and discussed in the Specifications and CQA Manual, including but not limited to: placement of ballast to prevent wind uplift; provide field quality control; furnish two calibrated tensiometers for use by Quality Control and CQA MANAGER; repair of damaged installed geomembrane as necessary; and protection of installed geomembrane until acceptance by the OWNER. GEOSYNTHETICS INSTALLER is responsible for providing deployment equipment. A geomembrane panel layout shall be provided prior to start of work. GEOSYNTHETICS INSTALLER shall also provide a Record Drawing showing panel number, seams, and destructive test locations. OWNER shall supply the double-sided textured geomembrane. GEOSYNTHETICS INSTALLER is responsible for unloading double-sided textured geomembrane from storage and hauling to WORK area.

2. UNIT OF MEASURE: Square footage of double-sided textured geomembrane installed.

3. MEASUREMENT: The total quantity of double-sided textured geomembrane for which payment shall be made shall be the square footage of double-sided textured geomembrane installed as determined by field surveys.

Item 4 - Installation of Pipe Penetration

1. PAYMENT: Full compensation for all labor, materials, equipment, and other incidental costs associated with installing pipe penetration through existing leachate collection pond liner system. OWNER shall supply the double-sided textured geomembrane and GCL, as necessary. GEOSYNTHETICS INSTALLER is responsible for unloading double-sided textured geomembrane and GCL from storage and hauling to work area.

2. UNIT OF MEASURE: Lump sum

3. MEASUREMENT: There shall be no measurement for payment.

1.7 BID ALTERNATE ITEM DESCRIPTIONS

Item 5 – Installation of Geocomposite

1. PAYMENT: Full compensation for all labor, materials, equipment, and other incidental costs necessary to unload from storage, haul to work area, and install geocomposite as shown in the Contract Drawings as a bid alternate and as discussed in the Specifications and CQA Manual, including but not limited to: acceptance; protection of installed geocomposite; repair of damaged geocomposite as necessary; and field quality control. OWNER shall supply the geocomposite material. GEOSYNTHETICS INSTALLER is responsible for unloading geocomposite from storage and hauling to work area.

2. UNIT OF MEASURE: Square footage of geocomposite installed.

3. MEASUREMENT: The total quantity of geocomposite for which payment shall be made shall be the square footage of geocomposite installed as determined by field surveys.
PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

***END OF SECTION***
SECTION 01 31 13
PROJECT COORDINATION

PART 1 – GENERAL

1.1 DESCRIPTION

A. Section includes:
   1. Requirements for project coordination between Contractors, utilities, and Site operations
   2. Requirements for project meetings including, but not limited to, the following:
      a. Pre-construction meeting.
      b. Progress meetings.
      c. Specially called meetings throughout the progress of the Work.

1.2 RESPONSIBILITIES

A. CONTRACTOR shall be solely responsible for coordination of the Work with the OWNER, CQA MANAGER, GEOSYNTHETICS INSTALLER, all subcontractors, suppliers, testing agencies, and others with whom coordination is necessary to complete the Work within the Contract Time and in accordance with the Contract Documents.

B. CONTRACTOR shall cooperate fully with other Contractors, including the CQA MANAGER, GEOSYNTHETICS INSTALLER, and GEOSYNTHETICS MANUFACTURER.

C. Scheduling and administration of project meetings is the responsibility of the OWNER’S REPRESENTATIVE. The responsibilities include, but are not limited to the following:
   1. Prepare agendas.
   2. Distribute written notice and agendas of regular and specially called meetings (4) four days in advance of meeting date.
   3. Make physical arrangement for meetings.
   4. Preside at the meetings.
   5. Record minutes and include significant proceedings and decisions.
   6. Distribute copies of minutes within three days after each meeting:
      a. To all participants in meeting.
      b. To all parties affected by decisions made at the meeting.

D. Representatives of CONTRACTOR and subcontractors attending the meetings shall be qualified and authorized to act on behalf of the entity each represents.

1.3 COORDINATION WITH OWNER

A. CONTRACTOR shall construct all Work in accordance with the lines and grades shown in the Contract Drawings, and as designated by OWNER and CQA MANAGER.
B. CONTRACTOR shall maintain a full-time on-site Superintendent for the duration of the Work. The Superintendent shall be responsible for the supervision of and/or coordination of all CONTRACTOR employees any subcontractors employed. The Superintendent shall have sufficient qualifications, experience, and authority to act as a single point of contact for the on-site staff, and to make adjustments to the means and methods as needed and as requested by the OWNER and CQA MANAGER.

C. CONTRACTOR shall coordinate on-site staging areas, access, and temporary facilities with OWNER.

D. For additional information, contact Matt Theriault at the City of Cheyenne Landfill Manager at (307) 637-6279.

1.4 COORDINATION OF CONSTRUCTION

A. CONTRACTOR is responsible for coordinating Work by preparation of schedules and progress reports, coordination of Record Drawings, and other work as necessary.

B. CONTRACTOR shall coordinate with CQA MANAGER on survey requirements; see Section 01 71 23 Surveying.

C. Several components of the WORK will require coordination with the GEOSYNTHETICS INSTALLER. CONTRACTOR shall work with GEOSYNTHETICS INSTALLER to schedule the Work to produce orderly, continuous progress and avoid delays due to lack of materials, subcontractor schedules, lack of available manpower, etc.

D. CONTRACTOR shall coordinate with owner on electrical service installation to leachate collection and recovery system (LRCS) cell discharge pipe system locations along the force main.

E. CONTRACTOR is responsible for ensuring that installed Work is complete and satisfactory prior to enclosing or covering. CONTRACTOR shall call for required inspections in a timely manner and shall not cover Work that requires inspection.

1.5 PRE-CONSTRUCTION MEETING

A. Time: Schedule within seven (7) days before the date of commencement of the Work established in the Contract Documents.

B. Location: Project site office of OWNER, except as otherwise designated in the meeting notice.

C. Attendance:
   1. OWNER’s REPRESENTATIVE
   2. CONTRACTOR
   3. Subcontractors
   4. Site Operator
   5. Site contractors
D. Minimum agenda
1. Distribution and discussion of:
   a. Schedule of Values
   b. Work phasing schedule
   c. Project progress schedule
   d. CONTRACTOR’s Health and Safety Plan
2. Critical work sequencing.
3. Use of Premises:
   a. Access to project site.
   b. Office, work and storage areas.
5. Work coordination:
   a. Relation and coordination with existing site operations.
   b. Relation and coordination of subcontractors.
   c. Designation of responsible personnel.
6. Procedures and processing of:
   a. Field decisions.
   b. Proposal requests.
   c. Submittals.
   d. Change orders.
   e. Application of payment.
8. Procedures for maintaining record documents.
10. Temporary utilities.

1.6 PROGRESS MEETINGS

A. Time:
1. Schedule regular periodic meetings as required by OWNER, but not less than every seven days, except as otherwise required.
2. Hold specially called meetings as required by work operations, progress of the work or as required by OWNER.

B. Location: Project site office of the OWNER, except as otherwise designated in the meeting notice.

C. Attendance:
1. OWNER’s REPRESENTATIVE
2. CONTRACTOR
3. Subcontractors
4. Site contractors

D. Minimum agenda:
1. Review and acceptance of minutes of previous meeting.
2. Review of work progress since previous meeting.
4. Note field observations, problems and decisions.
5. Discuss any problems which may impede planned progress.
6. Develop corrective measures and procedures to regain projected
progress schedule.
7. Revisions to progress schedule as required.
8. Plan progress for periods after the initial work period.
9. Coordinate projected progress with separate contractors as needed.
10. Review submittals schedules and expedite as required to maintain project progress schedule.
12. Review proposed changes for:
   a. Effect on progress schedule.
   b. Effect on completion date.
   c. Effect on separate contracts of Project.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 COORDINATION WITH PUBLIC AND PRIVATE UTILITIES

A. CONTRACTOR is responsible for locating and protecting existing underground improvements. Contact all utility companies for location of their facilities. To contact all utility companies for locates, call (800) 849-2476 and 811, at least 48 hours prior to excavation.

B. CONTRACTOR shall have personnel available to maintain the Work, as required, 24 hours per day every day. CONTRACTOR is responsible for housekeeping, dust and erosion control, and shall provide all equipment and personnel necessary to meet the requirements of this responsibility. CONTRACTOR shall provide OWNER and CQA MANAGER with the name(s) and telephone number(s) of the person(s) designated to be available for after-hours contact. If this person cannot be contacted, OWNER may use its equipment to correct problems. In this case, CONTRACTOR shall pay all costs incurred by OWNER.

C. CONTRACTOR shall not utilize private property for any purpose without written permission from the property owner.

3.2 TRAFFIC CONTROL

A. CONTRACTOR shall coordinate all traffic control with CQA MANAGER, and if directed, with the OWNER. Traffic control is required to comply with current Manual of Uniform Traffic Control Devices (MUTCD) as applicable.

B. CONTRACTOR to provide necessary signage to adequately protect public from the construction and direct them around the facility during normal hours of operation.

C. Prior to implementing any phase of the project that will require traffic control, CONTRACTOR will submit the plan to the CQA MANAGER for approval.

***END OF SECTION***
PART 1 – GENERAL

1.1 DESCRIPTION

A. Section includes: Requirements for CONTRACTOR’s Health and Safety Plan (HASP).

B. The CONTRACTOR shall, for the purposes of the Occupational Health and Safety Act and for the duration of the Work of this Contract, be the “prime contractor” for the “work site” and do everything that is reasonably practicable to establish and maintain a system or process that will ensure compliance with the Act and its regulations, as required to ensure the health and safety of all persons at the “work site.”

1.2 REFERENCES

A. Regulatory Requirements: Laws and Regulations applying to the Work under this Section include, but are not limited to:
   1. 29 CFR Part 1904 (OSHA), Recording and Reporting Occupational Injuries and Illnesses.
   2. 29 CFR 1910 (OSHA), Occupational Safety and Health Standards.
   3. 29 CFR 1926 (OSHA), Safety and Health Regulations for Construction.
   4. 49 CFR 171.8, Transportation, Definitions and Abbreviations.
   5. 49 CFR 258, Criteria for Municipal Solid Waste Landfills
   7. Wyoming Occupational Safety and Health Administration (Wyoming OSHA) regulations

1.3 SUBMITTALS

A. CONTRACTOR shall submit HASP to the OWNER’S REPRESENTATIVE prior to pre-construction conference.
   1. OWNER’S REPRESENTATIVE’s review and acceptance of HASP will be only to determine if the topics covered in HASP comply with the Contract Documents.
   2. OWNER’S REPRESENTATIVE’s review and acceptance will not extend to safety measures, means, methods, techniques, procedures of construction, or whether representations made in the HASP comply with Laws and Regulations, or standards of good practice.

B. WORK at the Site will be prohibited until the written HASP has been accepted by OWNER’s REPRESENTATIVE.

C. Notwithstanding other provisions of the Contract Documents, changes in the Contract Price or Contract Times will not be authorized due to delay by
1.4 CONTRACTOR’S HEALTH AND SAFETY PROGRAM

A. CONTRACTOR shall prepare and maintain a written, Site-specific, Health and Safety Plan (HASP), and conduct all construction activities in a safe manner that avoids:
   1. Injuries to employees, subcontractors, and other persons with an interest at or near the Site;
   2. Significant increases in concentrations of contaminants in soil, water, or sediment near the Site; or
   3. Violations of OSHA, or other Laws or Regulations.

B. The HASP shall be prepared submitted by the CONTRACTOR and approved by the OWNER. The HASP will be kept at the Site, and shall address safety and health hazards of each phase of Work at the Site and shall include requirements and procedures for employee protection. The HASP shall address and include the following:
   1. CONTRACTOR’s organizational structure.
   2. Comprehensive work plan.
   3. Safety and health risk or hazard analysis for each task and operation found in the work plan.
   4. Contingency planning for handling and management of regulated waste types.
   5. Employee training assignments including copies of OSHA 24-hour supervised field activities and eight-hour refresher training certificates for each CONTRACTOR and subcontractor.
   6. Personal protective equipment (PPE) to be used by employees for each task and operation being conducted and decontamination procedures.
   7. Medical Surveillance Requirements: Medical clearance certificates for all CONTRACTOR and subcontractor employees assigned to the Project.
   8. Frequency and types of air monitoring, personnel monitoring, and environmental sampling techniques and instrumentation to be used, including methods of maintenance and calibration of monitoring and sampling equipment.
   9. Site control measures, including:
      a. Preventing trespassing;
      b. Preventing unqualified or unprotected workers from entering restricted areas by development of safe work zones and site controls;
      c. Preventing "tracking" of contaminants out of the Site;
      d. Maintaining log of employees at the Site and visitors to the Site;
      e. Communicating routes of escape and gathering points.
      f. Air emissions controls (for each type of waste that may be encountered).
   10. Response plan for safe and effective responses to special waste and hazardous waste including necessary PPE and other equipment.
   11. Handling and sampling of intact drums.
B. Organizational Structure:
   1. Organizational structure portion of the HASP shall refer to or incorporate
      information on specific chain of command and specify the overall
      responsibilities of supervisors and employees, and shall include the
      following:
         a. Designation of general supervisor who has responsibility and
            authority to direct all operations.
         b. Name of Site safety representative who has responsibility and
            authority to implement and modify the HASP and verify compliance.
         c. Other personnel required for operations at the Site and emergency
            response, and general functions and responsibilities of each.
         d. Lines of authority, responsibility, and communication.
   2. Review and update organizational structure as necessary to reflect current
      status of Site operations and personnel.

1.5 ACCIDENT REPORTING AND INVESTIGATION

A. Comply with 29 CFR 1904.29, including using OSHA 300, 300-A, and 301 forms
   (or equivalent) to document all accidents that result in bodily injury.

B. Submit copies of completed accident reports to OWNER’s REPRESENTATIVE.

C. Based upon results of accident investigation, modify the HASP as required by
   changing tasks or procedures to prevent reoccurrence of accident.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

***END OF SECTION***
SECTION 01 40 00

QUALITY ASSURANCE AND QUALITY CONTROL REQUIREMENTS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Section includes: administrative and procedural requirements for quality assurance (QA) and quality control (QC).

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve CONTRACTOR of responsibility for compliance with the Contract Document requirements.

1.2 DEFINITIONS

A. Construction Quality Control (CQC): A planned system of inspections that is used to directly monitor and control the quality of a construction project. CQC is normally performed by the material/equipment installer or for natural soil materials by the CONTRACTOR, and is necessary to achieve quality in the constructed or installed system. CQC refers to measures taken by the Installer or CONTRACTOR to determine compliance with the requirements for materials and workmanship as stated in the Contract Documents.

B. Construction Quality Assurance (CQA): A planned system of activities that provides the OWNER assurance that the facility was constructed as specified in the design. CQA includes inspection, verifications, audits, and evaluations of materials and workmanship necessary to determine and document the quality of the constructed facility.

1.3 RESPONSIBILITIES

A. The CQA MANAGER will be responsible for all Quality Assurance testing as outlined in this Specification and the Construction Quality Assurance (CQA) Manual, unless otherwise noted.

B. The CONTRACTOR shall maintain an effective Construction Quality Control program. The system shall encompass all action involving selection of construction material sources and on-site and off-site production of construction materials, WORK placement procedures, workmanship, and as required, monitoring and testing.

1.4 TESTING AND FREQUENCY

A. Quality Control/Quality Assurance tests and frequency are discussed throughout the Specifications and in the CQA Manual. The frequencies indicated are minimums only, and do not include re-testing of failed materials. Those Quality Control/Quality Assurance tests and testing frequencies to be conducted in the field by the CQA MANAGER are presented in the CQA Manual.
1.5 QUALITY OF MATERIALS AND LABOR

A. All materials used on this Contract shall be new and the best market quality, unless specified or shown otherwise. All labor on this contract shall be competent and skilled for the Work. All Work executed under this contract shall be done in the best, most thorough, substantial and workmanlike manner. All material and labor shall be subject to the approval of the CQA MANAGER as to quality and compliance with the design and the Contract Documents and shall be removed if it does not meet with these requirements. The OWNER or CQA MANAGER may refuse to issue any certificate or payment until all defective materials or Work have been removed, and other material of proper quality substituted therefore. The cost associated with wasted or improperly installed materials that are placed by reasons of the failure of the CONTRACTOR to conform to the provisions of the Contract will not be paid for. This includes, but is not restricted to, additional quantities of materials, delays, Work, loading, hauling or disposal of the rejected materials.

B. All off-site earth materials proposed for use in the project shall be reviewed for the content of asbestos and other potential hazards or contamination.

1.6 CONTRACTOR RESPONSIBILITIES

A. The CONTRACTOR is responsible for the quality of the Work of the Contract.

B. The CONTRACTOR shall make good all Work for which any test result indicates the Work does not conform to the requirements of the Contract.

C. The CONTRACTOR shall certify that all equipment used in the Work is in accordance with the provisions of the Contract. Certification does not relieve responsibility for providing satisfactory materials, equipment, and workmanship.

D. Any inspection and/or testing shall not relieve the CONTRACTOR from any responsibility for the quality of the Work.

E. The CONTRACTOR shall be aware of all testing activities as presented in the CQA Manual and shall account for those activities in the construction schedule.

F. The CONTRACTOR shall be responsible for cooperating with the CQA MANAGER during all testing activities. CONTRACTOR shall provide equipment and labor to assist the CQA MANAGER in sampling, if requested, and shall also provide access to all areas requiring testing activities.

G. No Work shall be covered before the CQA MANAGER has approved the Work. If any material is covered without the approval of the CQA MANAGER, the CONTRACTOR will be required to re-excavate to expose the covered materials. The cost of exposing those materials and then backfilling and re-compacting, or otherwise doing rework, will be at the CONTRACTOR'S expense, regardless of the condition of the materials under question.

H. Upon start of installation of granular drainage/operations layer, CONTRACTOR shall be responsible for protection and maintenance of the geomembrane.
SECTION 01 71 23
SURVEYING

PART 1 – GENERAL

1.1 SUMMARY

A. The CQA MANAGER will provide layout of work surveys and certification surveying services required for the work.
   1. Layout of work surveys will be provided over the course of four site mobilizations.
   2. Certification surveying will be provided over the course of six site mobilizations.
   3. As-built surveys will be provided over the course of two site mobilizations

B. The CONTRACTOR shall supply all construction surveying services not provided by the CQA MANAGER for the Work.

C. The OWNER will provide the CONTRACTOR electronic versions and TIN surfaces from the Contract Drawings.

D. Any disputes that arise in the survey shall be brought to the attention of the OWNER's REPRESENTATIVE immediately and will be resolved in a timely manner.

E. All surveys shall be conducted by a Wyoming Licensed Land Surveyor and sealed.

1.2 DATUM

A. The horizontal coordinate system is NAD83.

B. The vertical datum is NAVD29.

1.3 PRIMARY CONTROL

A. The OWNER has established primary control to be used for establishing work lines and grades. Primary control consists of benchmarks and horizontal control points in the Work vicinity as shown in the Contract Drawings.

B. CONTRACTOR shall preserve and maintain primary control points until otherwise authorized.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 LAYOUT OF WORK SURVEYS

A. The CQA MANAGER shall establish lines and grades for work layout as follows:
   1. Slope stake excavation limits prior to construction at 50' intervals around the construction limits and outer extent of stockpiles.
2. Layout liner system limits, anchor trench, earthen berms, and stormwater channels.
3. Layout leachate collection system side slope riser pipes, leachate collection sump, force main, and utility trench corridors.

B. The CQA MANAGER will establish measurements required for work execution to the specified tolerances.

C. The CONTRACTOR shall provide stakes, markers, and other survey controls necessary to control, check, and guide construction to ensure all Work is constructed in a manner which meets the tolerances described in Part 3.4 of this Section.

D. The CONTRACTOR shall be responsible for coordinating verification or measurements for planning and executing their own Work and that of any of their Subcontractors.

3.2 QUANTITY SURVEYS

A. CONTRACTOR shall perform surveys and computations to determine quantities of work performed for progress payments. OWNER will provide a topographic survey of the Work area prior to CONTRACTOR commencing earthmoving activities.

B. CQA MANAGER shall perform surveys necessary for CQA MANAGER to determine final quantities of work in place.

3.3 AS-BUILT SURVEYS AND RECORD DRAWINGS

A. CQA MANAGER shall perform final as-built surveys necessary for CQA MANAGER to verify that Work was completed to the lines and grades shown in the Contract Drawings.

B. CONTRACTOR shall notify CQA MANAGER a minimum of three (3) days in advance of anticipated completion dates for Work that will require as-built record surveying, including certification surveys of the subgrade, operations/drainage layer, and leachate collection and recovery (LCRS) components of the liner system.

C. CONTRACTOR shall maintain a clean, undamaged set of black line prints of the Contract Drawings. The CONTRACTOR shall mark up the set to show the actual installation, where the installation varies substantially from the WORK as originally shown. The CONTRACTOR shall mark whichever drawing is most capable of showing conditions fully and accurately. The CONTRACTOR shall give particular attention to concealed elements that would be difficult to measure and record at a later date.

3.4 ACCURACY AND TOLERANCES

A. Degree of Accuracy
1. The accuracy of surveys shall be appropriate to meet the tolerances specified herein and shall be approved by the CQA MANAGER.
2. The tolerances for construction, unless otherwise approved by the CQA MANAGER, shall be as follows:
a. Slopes:
   i. Line: ± 0.2 feet
   ii. Grade: ± 0.1 feet
b. Floors:
   i. Line: ± 0.2 feet
   ii. Grade: ± 0.1 feet
c. Sand drainage layer (bid alternate operations layer) thickness
   i. Thickness: + 0.1 feet

3. Cross-Section points: Locate within 0.10 foot, horizontally and vertically.

B. A record survey will be conducted on areas deemed final by the CQA MANAGER and approved by the CQA MANAGER. The CQA MANAGER will notify the CONTRACTOR of compliance with design grades and tolerances.

C. Any areas out of tolerance will be repaired by the CONTRACTOR at no additional cost to the OWNER. Quantities for final payment will be based on this record survey and will be calculated by the and verified by the CQA MANAGER.

3.5 PRESERVATION OF CONTROL POINTS AND STAKES

A. Control points and stakes lost or damaged during construction, unless previously authorized, shall be reset at the CONTRACTOR’s expense.
1.1 SUMMARY

A. Scope:
1. This section describes the general requirements for the manufacture, supply, installation, and quality control (QC) of geotextile fabric associated with the Work.
2. The geotextile will be procured directly by the OWNER from the GEOSYNTHETICS MANUFACTURER. The CONTRACTOR shall be responsible for unloading, storing, and installing the geotextile fabric as specified.

B. RELATED SECTIONS
1. Section 31 05 19.16  Geomembranes for Earthwork
2. Section 31 05 19.23  Geosynthetic Clay Liners
3. Section 31 23 00  Excavation and Fill
4. Section 33 46 16  Subdrainage Piping

1.2 REFERENCES

A. Latest Version of American Society for Testing and Materials (ASTM) standards:
2. ASTM D4491- Standard Test Methods for Water Permeability of Geotextiles by Permittivity
4. ASTM D4632 - Standard Test Method for Breaking Load and Elongation of Geotextiles (Grab Method)
7. ASTM D5199 - Standard Test Method for Measuring Geotextiles
8. ASTM D5261- Standard Test Method for Measuring Mass Per Unit Area of Geotextiles

1.3 SUBMITTALS

A. The GEOSYNTHETICS MANUFACTURER shall provide the following information after Contract award, but no later than 14 days prior to material arrival on site and prior to commencement of the Work:
1. Written certification that the geotextile to be used meets the requirements of the Project.
2. Certificates of origin and the manufacturer of the resin
3. A copy of the manufacturer’s geotextile QC test results of properties outlined in Part 2 of this Section. The CQA MANAGER reserves the right to refuse use of any geotextile supplied without the proper QC documentation.

4. A detailed list of performance criteria for the geotextile material being produced for the Project. Refer to Part 2 of this Section for geotextile properties and test methods.

1.4 QUALITY ASSURANCE

A. The GEOSYNTHETICS MANUFACTURER shall ensure that their internal product quality control program meets the Contract requirements.

B. GEOSYNTHETICS MANUFACTURER shall provide required QC information at least 14 days prior to geotextile being shipped to the Site for review and approval by the OWNER’s REPRESENTATIVE. GEOSYNTHETICS MANUFACTURER shall also assure that the geotextile is delivered to the site at least five calendar days prior to installation.

C. Geotextile rolls that do not meet the performance criteria requirements shall be rejected. GEOSYNTHETICS MANUFACTURER shall be required to replace the rejected material with new material that complies with the performance criteria requirements, at no additional cost to OWNER.

1.5 DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping
   1. Geotextile fabric shall be supplied in rolls wrapped in relatively impermeable and opaque protective covers, with straps for unloading.
   2. Geotextile rolls shall be marked or tagged with the following information.
      a. Manufacturer’s name
      b. Product information
      c. Roll number
      d. Batch of lot number
      e. Roll dimensions
   3. The GEOSYNTHETICS MANUFACTURER shall ensure that geotextile rolls are properly loaded and secured to prevent damage during transit.
   4. The GEOSYNTHETICS MANUFACTURER shall protect geotextile from excessive heat, puncture, cutting, or other damaging or deleterious conditions during shipping and delivery.
   5. The GEOSYNTHETICS MANUFACTURER shall ensure personnel responsible for loading and transport are familiar with handling and transport constraints imposed by Manufacturer and as required by this SPECIFICATION.
   6. The CONTRACTOR shall ensure personnel responsible for unloading and storing materials on site are familiar with handling and transport constraints imposed by Manufacturer and as required by this SPECIFICATION.

B. Acceptance at the Site
   1. The CQA MANAGER shall perform inventory and surface inspection for defects and damage of all geotextile rolls upon delivery.
   2. The CONTRACTOR shall unroll and allow for the CQA MANAGER inspection of any geotextile roll that may be damaged below surface layers.
3. The GEOSYNTHETICS MANUFACTURER shall repair damage resulting from handling and transport of geotextile to site at no cost to OWNER. If irreparable, in the opinion of CQA MANAGER, damaged materials shall be replaced at no cost to OWNER.

C. Storage and Protection
1. OWNER shall provide on-site storage area for geotextile rolls from time of delivery until installation.
2. The offloading and storage of the materials is the responsibility of the CONTRACTOR from the time the materials are off-loaded and inspected by the CQA MANAGER until the time the completed installation is accepted. CONTRACTOR is also responsible for offloading from shipper to storage and for preparing the storage location, off the ground, and for the protection of the material from the elements (e.g. ultraviolet light, moisture, temperature, etc.).
3. After CONTRACTOR has removed material from storage area, protect geotextile from puncture, dirt, groundwater, moisture, mud, mechanical abrasion, excessive heat, ultraviolet light exposure, and other sources of damage.
4. Geotextile rolls shall be stored in relatively opaque and water tight wrappings.
5. CONTRACTOR shall preserve integrity and readability of the geotextile roll labels, and store such that CQA MANAGER shall have access to the package slips or roll labels for each roll to verify roll acceptance. The CQA MANAGER will perform inventory and surface inspection for any defects or damage to rolls upon delivery. The GEOSYNTHETICS MANUFACTURER shall replace any defective or damaged rolls at no cost to the OWNER.

PART 2 - PRODUCTS

2.1 GEOTEXTILE FABRIC

A. The geotextile fabric shall be non-woven, needle punched, and shall be comprised of 95 percent polypropylene or polyester fibers by weight. Rolls shall be free of holes, contamination, and foreign matter. The geotextile for the project shall meet or exceed the minimum (unless noted otherwise) roll values shown in Table 31 05 19.13-1 below:

<table>
<thead>
<tr>
<th>Fabric Property</th>
<th>ASTM Test Method</th>
<th>Unit</th>
<th>Minimum Value</th>
<th>Minimum Value</th>
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<tr>
<td>Mass Per Unit Area</td>
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<td>16</td>
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<td>lbs</td>
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<td>150</td>
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<tr>
<td>Grab Strength</td>
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<td>lbs</td>
<td>300</td>
<td>425</td>
</tr>
<tr>
<td>Mullen Burst Strength</td>
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<td>650</td>
<td>800</td>
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<tr>
<td>Puncture Resistance</td>
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<tr>
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<td>D4491</td>
<td>s⁻¹</td>
<td>0.90</td>
<td>0.57</td>
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<tr>
<td>AOS</td>
<td>D4751</td>
<td>mm</td>
<td>0.150</td>
<td>0.150</td>
</tr>
</tbody>
</table>
PART 3 – EXECUTION

3.1 INSPECTION

A. CONTRACTOR shall verify the elevations and observe the conditions under which the Work is to be performed. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the CQA MANAGER.

B. CONTRACTOR shall review installation procedures under other Sections and coordinate the installation of items that must be installed prior to and/or with the geotextile fabric.

3.2 INSTALLATION

A. CONTRACTOR shall place geotextile fabric according to Manufacturer’s recommendations.

B. Geotextile seams shall be secured in accordance with manufacturer’s recommendations or as approved by CQA MANAGER. Geotextile seams shall be overlapped a minimum of 12 inches.

C. The CONTRACTOR shall examine the entire geotextile surface after installation to ensure, to the satisfaction of the CQA MANAGER that no potentially harmful foreign objects are present. Such foreign objects shall be removed and damaged geotextile shall be repaired or replaced by the CONTRACTOR at no cost to OWNER.

D. CONTRACTOR shall use care not to damage underlying materials during installation.

E. CONTRACTOR shall prevent the geotextile from accumulating excessive dust.

F. The CONTRACTOR shall be responsible for field handling, storing, deploying, seaming or connecting, temporary restraining (against wind), anchoring, and other aspects of geotextile installation.

G. The CONTRACTOR shall accept and retain full responsibility for all materials upon delivery to the Site through installation and shall be held responsible for any defects.

H. No equipment shall operate directly on geotextile fabric.

3.3 REPAIRS

A. Any holes or tears in the geotextile shall be repaired using a geotextile patch consisting of the same geotextile secured with a 12-inch overlap in all directions.

B. Damaged areas too large for patching shall be removed and replaced as directed by the CQA ENGINEER.
3.4 PLACEMENT OF SOIL OR GRANULAR MATERIALS

A. All soil or granular materials located on top of a geotextile shall be placed in such a manner as to ensure:
   1. The geotextile and/or underlying geosynthetic are not damaged.
   2. Minimal slippage of the geotextile on underlying layers occurs.
   3. Minimal movement and wrinkling or folding of the underlying geosynthetic layer(s) occurs.
   4. No excess tensile stresses shall occur in the geotextile, such as by earth moving equipment making sudden starts, stops, or turns. The allowable ground pressure for equipment shall be prescribed by these Specifications and/or the CQA MANAGER for the material type and layer thickness.

***END OF SECTION***
SECTION 31 05 19.16
GEOMEMBRANES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope
1. This section describes the general requirements for the manufacture, supply, installation, and quality control (QC) of High-Density Polyethylene (HDPE) geomembrane associated with the Work.
2. The geomembrane will be procured directly by the OWNER from the GEOSYNTHETICS MANUFACTURER. The CONTRACTOR shall be responsible for unloading, storing, and installing the geomembrane as specified.

B. Related Sections
1. Section 31 05 19.13 Geotextiles for Earthwork
2. Section 31 05 19.23 Geosynthetic Clay Liners
3. Section 31 23 00 Excavation and Fill

1.2 REFERENCES

A. Latest Version of American Society for Testing and Materials (ASTM) standards:
2. ASTM D1004 Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
3. ASTM D1204 Standard Test Method for Linear Dimensional Changes of Non-rigid Thermoplastic Sheeting or Film at Elevated Temperature.
8. ASTM D5321 Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic Friction by the Direct Shear Method
9. ASTM D5397 Notched Constant Tensile Load Test for Geomembrane.
13. ASTM D6392 Standard Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods
1.3 PRE-QUALIFICATION

A. The GEOSYNTHETICS INSTALLER shall pre-qualify for geosynthetic installation by providing the following qualification documentation:
   1. The GEOSYNTHETICS INSTALLER shall have a minimum of 10,000,000 square feet (sf) of HDPE geosynthetic cumulative installation experience.
   2. The GEOSYNTHETICS INSTALLER shall provide at least three references from prior installation projects in excess of 500,000 sf including the following information:
   a. Client’s name, address, phone number and contact or representatives name.
   b. Project site and description.
   c. Geosynthetic type(s) and quantity installed.

B. The installation crew shall have the following experience.
   1. The superintendent shall have supervised the installation of a minimum of 2,000,000 ft² of polyethylene geomembrane and 500,000 ft² of geotextile.
   2. The master seamer shall have experience seaming a minimum of 1,000,000 ft² of polyethylene geomembrane using the same type of seaming apparatus to be used at this site.
   3. All other seaming personnel shall have seamed at least 100,000 ft² of polyethylene geomembrane using the same type of seaming apparatus to be used at this site. Personnel who have seamed less than 100,000 ft² of polyethylene geomembrane shall be allowed to seam only under the direct supervision of the master seamer or Superintendent.

1.4 SUBMITTALS

A. The GEOSYNTHETICS MANUFACTURER shall furnish the following in writing to the CQA MANAGER a minimum of fourteen (14) calendar days prior to geomembrane shipment to the site:
   1. Quality Control Program:
      a. Certificates for each shift’s production of geomembrane, and statements of production dates.
      b. Certification stating all geomembrane rolls are furnished by one manufacturer, and all rolls are manufactured from one resin type obtained from one resin supplier.
      c. Copies of quality control certificates, including:
         i. Roll numbers and identification;
         ii. Sampling procedures; and
         iii. Results of quality control tests, including descriptions of the test methods used.
      d. The results of the manufacturing quality control tests shall meet or exceed the property values listed in Table 31 05 19.16-1.
2. Resin:
   a. Statement of production dates and origin of resin used to manufacture the geomembrane for the project.
   b. Certification stating all resin is from the same manufacturer and that reclaimed polymer added to the resin during the manufacturing of the geomembrane does not exceed 2 percent by weight.
   c. Copies of the quality control certificates issued by the manufacturer and resin supplier indicating that the resin used to manufacture the geomembrane meets these specifications.

3. Extrudate Beads and/or Welding Rod:
   a. Statement of production dates.
   b. Certification stating all extrudate is from one manufacturer, is the same resin type, and was obtained from the same resin supplier as the resin used to manufacture the geomembrane rolls.
   c. Copies of quality control certificates issued by the Manufacturer.

B. Prior to mobilization of the GEOSYNTHETICS INSTALLER to the Site, the GEOSYNTHETICS INSTALLER shall submit the following:
1. Shop drawings indicating panel layout and field seams. Each panel shall be assigned an identification number.
2. Installation schedule.
3. Copy of GEOSYNTHETICS INSTALLER letter of approval or license by the GEOSYNTHETICS MANUFACTURER.
4. Proposed installation capabilities, including:
   a. Information on equipment proposed for this project;
   b. Average daily production anticipated for this project; and
   c. Quality control procedures.
5. Resume of the superintendent and Quality Control Inspector for GEOSYNTHETICS INSTALLER to be assigned to this project, including dates and duration of employment. Substitution of these key personnel, without prior notification and approval by CQA MANAGER will be sufficient grounds for removal of GEOSYNTHETICS INSTALLER from the Project.
6. Resumes of all GEOSYNTHETICS INSTALLER personnel who will perform seaming operations on this project, including dates and duration of employment.

C. Immediately upon Notice of Award, CONTRACTOR shall make available to the CQA MANAGER samples of the geomembrane for interface shear testing and conformance testing.

D. During the installation, the GEOSYNTHETICS INSTALLER shall be responsible for the timely submission to the CQA MANAGER of subgrade acceptance certificates, signed by the GEOSYNTHETICS INSTALLER and CONTRACTOR, for each area to be covered by geosynthetic clay liner and geomembrane.

E. The GEOSYNTHETICS MANUFACTURER or GEOSYNTHETICS INSTALLER shall furnish the OWNER upon completion of the project:
1. A 20-year written warranty provided by the GEOSYNTHETICS MANUFACTURER against defects in material. Warranty conditions
concerning limits of liability will be evaluated and must be acceptable to the OWNER.

2. A 1-year warranty provided by the GEOSYNTHETICS INSTALLER against defects in workmanship. Warranty conditions concerning limits of liability will be evaluated and must be acceptable to the OWNER.

1.5 QUALITY ASSURANCE

A. All Work shall be constructed, monitored, and tested in accordance with the CQA Manual. The CONTRACTOR, GEOSYNTHETICS INSTALLER and GEOSYNTHETICS MANUFACTURER shall participate and comply with all items in the CQA Manual.

B. Geomembrane sampling shall be conducted by GEOSYNTHETICS INSTALLER in accordance with the specifications for the following:
   1. Conformance Testing
   2. Destructive Seam Testing

C. GEOSYNTHETICS INSTALLER shall attend a pre-installation conference. Attendance of parties directly affecting the WORK of this Section will be mandatory.

1.6 DELIVERY, STORAGE AND HANDLING

A. CONTRACTOR and GEOSYNTHETICS INSTALLER shall conform to the Manufacturer's requirements to prevent damage to geomembrane.

B. Transportation of the HDPE geomembrane by the GEOSYNTHETICS MANUFACTURER shall be through an independent trucking firm and shall be shipped via a closed or flatbed trailer.

C. Offloading and storage of the HDPE geomembrane shall be the responsibility of the CONTRACTOR. Handling and care of the HDPE geomembrane after acceptance by the CQA MANAGER, prior to and following installation, will be the responsibility of the GEOSYNTHETICS INSTALLER, until Final Acceptance of the liner system by the CQA MANAGER.

D. Delivery:
   1. GEOSYNTHETICS MANUFACTURER shall deliver materials to the site only after the CQA MANAGER approves the required submittals.
   2. All rolls of geomembrane delivered to the site shall be identified by the GEOSYNTHETICS MANUFACTURER at the factory with the following:
      a. Manufacturer’s name
      b. Product identification
      c. Lot number
      d. Roll number
      e. Roll dimensions
   3. CQA MANAGER and CONTRACTOR must be present when HDPE geomembrane is delivered to the site. GEOSYNTHETICS MANUFACTURER shall notify CQA MANAGER a minimum of 2 business days prior to delivery.
   4. CONTRACTOR is responsible for separating damaged rolls from undamaged rolls and storing at locations designated by the CQA MANAGER.
until proper disposition of material is determined by the OWNER and the CQA MANAGER.

5. The OWNER will be the final authority regarding damage.
6. CONTRACTOR shall separate rolls without proper documentation and store until the CQA MANAGER approval is received. Rolls or pallets without proper identification by GEOSYNTHETICS MANUFACTURER shall be subject to rejection.

E. On-site Storage:
1. CONTRACTOR shall store in space allocated by the OWNER.
2. Protect from puncture, dirt, grease, water, moisture, mud, mechanical abrasions, excessive heat or other damage.
3. Store on level prepared surface (not on wooden pallets).
4. Stack per Manufacturer's recommendation but no more than three rolls high.
5. CONTRACTOR shall preserve integrity and readability of the HDPE geomembrane roll labels, and store such that CQA MANAGER shall have access to the package slips or roll labels for each roll to verify roll acceptance.

F. On-site Handling:
1. GEOSYNTHETICS INSTALLER shall use appropriate handling equipment to load, move or deploy geomembrane rolls. Appropriate handling equipment includes cloth chokers and spreader bar for loading, spreader and roll bars for deployment. Dragging panels on ground surface will not be permitted.
2. GEOSYNTHETICS INSTALLER shall not fold geomembrane material; folded material shall be rejected.

G. Damaged Geomembrane:
1. Geomembrane damage will be documented by the CQA MANAGER.
2. Geomembrane found damaged upon arrival at the site shall be replaced by the GEOSYNTHETICS MANUFACTURER at no additional cost to the OWNER.

PART 2 - PRODUCTS

2.1 MATERIALS

A. The geomembrane shall be comprised of high-density polyethylene (HDPE) material as indicated in the Contract Drawings, manufactured of new, first-quality products designed and manufactured specifically for the purpose of liquid containment in hydraulic structures.

B. The geomembrane shall be produced free of holes, blisters, undispersed raw materials, or any sign of contamination by foreign matter. Any such defect shall be repaired in accordance with the repair procedures in this Section.

C. The geomembrane shall be manufactured with a minimum seamless width of 15 feet. There shall be no factory seams.

D. The primary geomembrane liner shall be HDPE 60 mil textured double-sided as indicated in the Contract Drawings.
E. The geomembrane shall be supplied in rolls; folds will not be permitted. Identify each roll with labels indicating lot number, roll number, thickness, length, width, manufacturer, and plant location.

E. Specifications for HDPE geomembrane properties are presented in Table 31 05 19.16-1. Supplied material shall conform to these properties based upon the manufacturer's QC testing and CQA conformance testing.

G. Resin:
   1. Shall be HDPE, new, first quality, compounded and manufactured specifically for producing HDPE geomembrane.
   2. Do not intermix resin types.
   3. Resin shall meet the following additional requirements of Table 31 05 19.16-2.

H. Extrudate Rod or Bead:
   1. Shall be made from same resin as the geomembrane.
   2. Additives shall be thoroughly dispersed.
   3. Shall be free of contamination by moisture or foreign matter.
   4. Shall meet the requirements of Table 31 05 19.16-3.
### TABLE 31 05 19.16-1
HDPE GEOMEMBRANE PROPERTIES

<table>
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<tr>
<th>Property</th>
<th>Qualifier</th>
<th>Units</th>
<th>Specification</th>
<th>Minimum Manufacturer QC Test Frequency</th>
<th>Test Method</th>
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<tr>
<td>Thickness</td>
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<td>Per roll</td>
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<td>2. Lowest individual for 8 of 10 values</td>
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<td>mils</td>
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<td>Per roll</td>
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<td>Density</td>
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<td>3. Yield Elongation</td>
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<td>Standard OIT, or High Pressure OIT</td>
<td></td>
<td>Min.</td>
<td>100</td>
<td>200,000 lb</td>
<td>ASTM D 3895</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Min.</td>
<td>400</td>
<td>200,000 lb</td>
<td>ASTM D 5885</td>
</tr>
<tr>
<td>Oven Aging at 85˚ C (6)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Standard OIT (min avg) - % retained after 90 days; or</td>
<td>min. avg.</td>
<td>%</td>
<td>55</td>
<td>per each formulation</td>
<td>ASTM D 5721</td>
</tr>
<tr>
<td>(b) High Pressure OIT (min avg) - % retained after 90 days</td>
<td>min. avg.</td>
<td>%</td>
<td>80</td>
<td>per each formulation</td>
<td>ASTM D 3895</td>
</tr>
<tr>
<td>UV Resistance (7)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Pressure OIT (8) (min avg) - % retained after 1600 hrs</td>
<td>min. avg.</td>
<td>%</td>
<td>50</td>
<td>per each formulation</td>
<td>GRI GM 11</td>
</tr>
</tbody>
</table>

### Notes
1. Lowest individual reading must be > 5 mil. Perform 10 readings for each side and calculate average for each side of every 2nd roll.
2. Type IV die ASTM D638 test specimen shall be used. Machine Direction (MD) and Cross Machine Direction (XMD) average values shall be on the basis of 5 test specimens each direction. Yield elongation is calculated using a gage length of 1.3 inches. Break elongation is calculated using a gage length of 2.0 inches.
3. The SP-NCTL test is not appropriate for testing geomembranes with textured or irregular rough surfaces. Test should be conducted on smooth edges of textured rolls or on smooth sheets made from the same formulation used for the textured sheet materials. The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer’s mean value via MQC testing.
4. Other means such as D 4218 (muffle furnace) are acceptable if an appropriate correlation to D 1603 (tube furnace) can be established.
5. Carbon Black Dispersion for 10 different views: All 10 in Categories 1 or 2
6. The manufacturer has the option to select either one of the OIT methods listed to evaluate the
antioxidant content in the geomembrane. Samples shall be evaluated at 30 and 60 days to compare with the 90-day response.

7. The condition of the test should be 20 hr. UV cycle at 75°C followed by 4-hr. condensation at 60°C.
8. The UV Resistance is based on the percent-retained value regardless of the original HP-OIT value.

### TABLE 31 05 19.16-2
HDPE RESIN PROPERTIES

<table>
<thead>
<tr>
<th>Test (^{(1,3)})</th>
<th>Test Designation</th>
<th>Minimum Manufacturer QC Test Frequency</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>ASTM D 1505 or ASTM D 792 Method B</td>
<td>(2)</td>
<td>≥ 0.932</td>
</tr>
<tr>
<td>Melt Index</td>
<td>ASTM D 1238 Condition E</td>
<td>(2)</td>
<td>&lt; 1.0 g per 10 minutes</td>
</tr>
<tr>
<td>OIT</td>
<td>ASTM D 3895 (1 atm at 200°C)</td>
<td>(2)</td>
<td>≥ 100 minutes</td>
</tr>
</tbody>
</table>

**Notes:**
1. Resin without carbon black
2. One test per resin batch
3. The manufacturer may choose either Standard OIT or High Pressure OIT to evaluate antioxidant content

### TABLE 31 05 19.16-3
EXTRUDATE OR BEAD PROPERTIES

<table>
<thead>
<tr>
<th>Test</th>
<th>Test Designation</th>
<th>Minimum Manufacturer QC Test Frequency</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>ASTM D 1505 or ASTM D 792 Method B</td>
<td>(1)</td>
<td>≥ 0.940</td>
</tr>
<tr>
<td>Carbon Black Content</td>
<td>ASTM D 1603</td>
<td>(1)</td>
<td>2-3%</td>
</tr>
<tr>
<td>Melt Index</td>
<td>ASTM D 1238 Condition E</td>
<td>(1)</td>
<td>&lt; 1.0 g per 10 minutes</td>
</tr>
</tbody>
</table>

**Notes:**
1. One test per resin lot or batch of extrudate or bead used for extrusion welding.
2.2 EQUIPMENT

A. Welding equipment and accessories of GEOSYNTHETICS INSTALLER shall meet the following requirements:
1. Equipped with gauges showing temperatures both in apparatus and at nozzle (extrusion welder) or at wedge (fusion welder).
2. Maintain adequate number of welding apparatus to avoid delaying work.
3. Use power source capable of providing constant voltage under combined-line load.
4. Provide secondary containment to catch spilled fuel under electric generator, if located on geomembrane.

B. GEOSYNTHETICS INSTALLER shall provide two (2) calibrated tensiometers (one for backup) capable of quantitatively measuring geomembrane strength:
1. Equipped with gauge accurate to ±2 lbs per inch of geomembrane width and capable of pulling at 2 inches per minute and 20 inches per minute.
2. Provide one inch die for cutting sample specimens.
3. Provide certificate of tensiometer calibration within the past 12-months.
4. CQA MANAGER shall be allowed to utilize tensiometers to conduct testing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. GEOSYNTHETICS INSTALLER shall verify in writing that the surface on which the geomembrane will be installed is acceptable. In so doing the Installation GEOSYNTHETICS INSTALLER shall assume full liability for the accepted surface.

B. The GEOSYNTHETICS INSTALLER shall be responsible for maintenance of the geomembrane covered geosynthetic clay liner once installation of geomembrane begins.

3.2 PREPARATION

A. GEOSYNTHETICS INSTALLER is to maintain the surface suitability and integrity until the lining installation is completed, leak location survey is completed and accepted.

B. GEOSYNTHETICS INSTALLER shall repair rough areas and any damage to the subgrade (below the geosynthetic clay liner) caused by installation of the lining and fill any ruts in subgrade caused by equipment prior to geosynthetic clay liner and geomembrane deployment.

3.3 DEPLOYMENT

A. Geomembrane shall not be deployed by GEOSYNTHETICS INSTALLER:
1. During precipitation;
2. In the presence of excessive moisture;
3. In areas of ponded water;
4. In the presence of excessive winds; and
5. In excessive heat or cold.
B. Each panel shall be marked with an “identification code” (number or letter) by the GEOSYNTHETICS INSTALLER consistent with the layout plan. The identification code shall be simple and logical. The number of panels deployed in one day shall be limited by the number of panels which can be seamed on the same day. All deployed panels shall be seamed to adjacent panels by the end of each day.

C. The following is the acceptable method of deployment by GEOSYNTHETICS INSTALLER:
   1. Use equipment which will not damage geomembrane by handling, trafficking, leakage of hydrocarbons or other means.
   2. Do not allow personnel working on geomembrane to wear damaging shoes, or engage in activities that could damage geomembrane.
   3. Smoking on the liner is prohibited.
   4. Round sharp corners of clamps and other metal tools used in the WORK area.
   5. Do not allow clamps and other metal tools to be tossed or thrown.
   6. Unroll panels with a method that protects geomembrane from scratches and crimps and protects soil surface and underlying geosynthetic clay liner from damage.
   7. Use a method to minimize wrinkles, especially differential wrinkles between adjacent panels.
   8. Place adequate hold-downs to prevent uplift by wind.
   9. Use hold-downs that will not damage geomembrane such as sandbags.
   10. Use continuous hold-downs along leading edges to minimize risk of wind flow under panels.
   11. Panels shall be deployed perpendicular to slope elevation contours and the generation of seams shall be minimized.
   12. Protect geomembrane in heavy traffic areas by geotextile, extra geomembrane or other suitable materials.
   13. Do not allow vehicular traffic including ATVs on geomembrane surface.
   14. Panels deployed on grades steeper than 12% shall extend a minimum of 5 feet and less than 10 feet beyond the crest or toe of that slope.
   15. Single-sided textured geomembrane shall be placed with textured side down.

D. GEOSYNTHETICS INSTALLER shall visually inspect sheet surface during unrolling of geomembrane and mark faulty or suspect areas for repair or test. Replace faulty (requires more than one patch per 200 square feet) geomembrane stock at no additional cost to the OWNER.

E. GEOSYNTHETICS INSTALLER shall deploy geomembrane in ambient temperatures less than 104 °F (40° C) and greater than 32° F (0° C), measured 6 inches above geomembrane surface. In prevailing warm or cold weather conditions deployment may be acceptable if the provisions for sampling in such conditions is satisfied (see Section 3.5 below). The geomembrane shall not be deployed during precipitation, in the presence of excessive moisture, in areas of ponded water, or in the presence of excessive winds.

F. GEOSYNTHETICS INSTALLER shall deploy HDPE in a relaxed manner and free of tension and stress. In areas where grade transitions occur, the geomembrane shall not be allowed to bridge or trampoline.
3.4 FIELD SEAMING BY GEOSYNTHETICS INSTALLER

A. Orient seams perpendicular to slope elevation contours, i.e., orient down (not across) slope and use seam numbering system compatible with panel number system.

B. Minimize the number of field seams in corners, odd-shaped geometric locations and outside corners.

C. Overlap panels by a minimum of 3 inches for extrusion welding and 4 inches for fusion welding. Use procedures to temporarily bond adjacent panels together that do not damage the geomembrane and that are not detrimental to seam weld material for extrusion welding.

D. Do not use solvent or adhesive unless product is approved in writing by the CQA MANAGER.

E. No horizontal seams shall be allowed on grades steeper than 12% or within 5 feet to 10 feet of the crest or toe of slopes. A horizontal seam is defined as more than half of the panel width.

F. Clean surface of grease, moisture, dust, dirt, debris or other foreign material.

G. Prior to any extrusion welding, the geomembrane seam or repair shall be prepared as follows:
   1. Clean surface of oxidation by disc grinder or equivalent not more than one hour before seaming; use number 80 grit sandpaper for the disc grinder. Bevel edges of geomembrane before bonding and provide continuous tacking in repair areas.
   2. Repair area where excessive grinding substantially reduces sheet thickness by more than 4 mils beyond extents of weld.
   3. Clean grinding dust around weld area after grinding.
   4. The following procedure shall be followed for wrinkles and fishmouths.
      a. Cut along the ridge of the wrinkle or fishmouth.
      b. Overlap a minimum of 3 inches and seam.
      c. Any portion where the overlap is less than 3 inches shall be patched with an oval or round patch of geomembrane that extends a minimum of 6 inches beyond the cut in all directions.
   5. If required, a firm, dry substrate (piece of geomembrane or other material) may be placed directly under the seam overlap to achieve proper support.
   6. Keep water from intercepting the weld during and immediately after welding the seam.
   7. For existing welds, or welds that are over 10 minutes old, grind the existing weld two inches back from point of termination and restart welding on ground weld.

H. At least one spare operable seaming apparatus shall be maintained for every three seaming teams. Place protective fabric or piece of geomembrane beneath hot
welding apparatus when resting on geomembrane lining and use an electric
generator capable of providing constant voltage under combined line load. The
electric generator shall be located outside of liner unless otherwise approved by
CQA MANAGER. Provide protective lining and secondary containment large
enough to catch spilled fuel under electric generators approved to operate on the
liner. The welding apparatus shall be equipped with gauges giving temperatures in
apparatus and at nozzle.

I. For extrusion welding, purge welding apparatus of heat-degraded extrudate before
welding if extruder is stopped for longer than five minutes. All purged extrudate
shall be disposed of off the geomembrane. Each extruder shoe shall be inspected
daily for wear to assure that its offset is the same as the geomembrane thickness.
Repair or replace worn shoes, damaged or mis-aligned armature brushes, nozzle
contamination, or other worn or damaged parts. Avoid stop-start welding. Remove
extrudate rod from welder when not using welder for long periods (over two hours).
No welding may commence on the liner until the field trial seam sample, made by
that equipment and seamer, passes destructive testing.

J. Test and set “hot air system” using scrap material at least each day prior to
commencing seaming and adjust hot air velocity to preclude wind effects. Adjust
contact pressure rollers to prevent surface ripples in sheet. No equipment shall be
used for welding the geomembrane until a field trial seam sample made by that
equipment has passed destructive testing.

K. In performing hot wedge welding, the welding apparatus shall be automated
vehicular mounted devices equipped with gauges giving applicable temperatures
and pressures. The edge of cross seams shall be ground to a smooth incline (top
and bottom) prior to welding. A smooth insulating plate or fabric shall be placed
beneath the hot welding apparatus after usage. Protect against moisture buildup
between sheets. If welding across cross seams, conduct field test seams at least
every two hours, otherwise once prior to start of work and once at mid-day. No
equipment is allowed to commence welding on geomembrane until the field trial
seam sample made by that piece of equipment has passed destructive testing.

L. Field trial seams shall be conducted, per seaming apparatus and per seamer, on
pieces of geomembrane liner to verify adequate seaming conditions at the following
frequency:
1. At beginning of each seaming period.
2. At least once every five hours.
3. At the discretion of the CQA MANAGER

M. Make the trial seams at area of seaming and in contact with subgrade or
geosynthetic clay liner (same condition as the liner to be seamed). The seam
sample shall be at least 42 inches long and 12 inches wide with the seam centered
lengthwise. A one-foot length of each trial seam sample shall be submitted to the
CQA MANAGER for archives. Cut three 1-inch wide specimens and test two for
peel adhesion, and one for bonded seam strength (shear). Each double wedge
fusion seam specimens shall be tested for peel on both sides of the weld. CQA
MANAGER shall have access to use GEOSYNTHETICS INSTALLER tensiometer.
A specimen passes when:
1. The break is film tearing bond (FTB) conforming to the values shown in
Table 31 05 19.16-4.
2. The break is ductile.
3. The strength of breaks for the trial seam testing shall conform to the values listed in Table 31 05 19.16-4.

### Table 31 05 19.16-4

**HDPE GEOMEMBRANE SEAM PROPERTIES**

<table>
<thead>
<tr>
<th>Property</th>
<th>Qualifier</th>
<th>Units</th>
<th>Specification</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shear Seam Strength</td>
<td>Min</td>
<td>lb/in.</td>
<td>120</td>
<td>ASTM D6392</td>
</tr>
<tr>
<td>Shear Elongation at break</td>
<td>≥</td>
<td>%</td>
<td>50</td>
<td>ASTM D6392</td>
</tr>
<tr>
<td>Peel Adhesion</td>
<td>min</td>
<td>lb/in.</td>
<td>91</td>
<td>ASTM D6392</td>
</tr>
<tr>
<td>Fusion</td>
<td>min</td>
<td>lb/in.</td>
<td>78</td>
<td>ASTM D6392</td>
</tr>
<tr>
<td>Extrusion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peel Separation</td>
<td>Maximum</td>
<td>%</td>
<td>25</td>
<td>ASTM D6392</td>
</tr>
<tr>
<td>Fusion/Extrusion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
1. Manufacturers use g/10 min as units.
2. All values, except when specified as minimum or maximum, represent average lot property values.
4. Film Tear Bond (FTB) is defined as failure of one of the sheets by tearing, instead of separating from the other sheet at weld interface area (sheet fails before weld).
5. Units, English or metric, shall be consistent with manufacturers specifications.
6. FTMS 101C Method 2065.

N. A trial seam sample passes when all specimens have passing results in peel and shear tests. If a specimen fails (one of the specimens fails in either peel or shear mode), the trial seam procedure shall be repeated in its entirety. If the repeated trial seam fails, the seaming apparatus or operator may not weld until the deficiencies or conditions are corrected and two consecutive passing field trial seams are achieved.

O. The following procedures shall be followed during cold weather conditions.
1. Geomembrane surface temperatures shall be determined by the CQA MANAGER at intervals of at least once per 100 feet of seam length to determine if preheating is required. For extrusion welding, preheating is required if the surface temperature of the geomembrane is below 32°F (0°C).
2. For fusion welding, preheating may be waived by the CQA MANAGER if the GEOSYNTHETICS INSTALLER demonstrates to the CQA MANAGER’s satisfaction that welds of equivalent quality may be obtained without preheating at the expected temperature of installation.
3. If preheating is required, the CQA MANAGER will observe all areas of geomembrane that have been preheated by a hot air device prior to seaming, to ensure that they have not been overheated.
4. Care shall be taken to confirm that the surface temperatures are not lowered below the minimum surface temperatures specified for welding due to winds or other adverse conditions. It may be necessary to provide wind protection for the seam area.
5. All preheating devices shall receive approval by the CQA MANAGER prior to use.

6. Additional destructive tests will be taken at an interval between 250 and 500 feet of seam length, at the discretion of the CQA MANAGER.

7. Sheet grinding may be performed before preheating, if applicable.

8. Trial seaming shall be conducted under the same ambient temperature and preheating conditions as the production seams. Under cold weather conditions, new trial seams shall be conducted if the ambient temperature drops by more than 20°F from the initial trial seam test conditions. Such new trial seams shall be conducted upon completion of seams in progress during the temperature drop.

P. The following procedures shall be followed during warm weather conditions.

1. At ambient temperatures above 104°F (40°C), no seaming of the geomembrane shall be permitted unless the Installation GEOSYNTHETICS INSTALLER can demonstrate to the satisfaction of the CQA MANAGER that the geomembrane seam quality is not compromised. Trial seaming shall be conducted under the same ambient temperature conditions as the production seams. At the option of the CQA MANAGER, additional destructive testing or trial seaming may be required for any suspected areas.

### 3.5 FIELD QUALITY CONTROL BY GEOSYNTHETICS INSTALLER

**A.** The GEOSYNTHETICS INSTALLER shall designate a full-time quality control (QC) technician who shall be responsible for supervising and/or conducting the field quality control program. The QC technician may not be replaced without written authorization by the CQA MANAGER.

**B.** All documentation will be completed on a daily basis by the GEOSYNTHETICS INSTALLER in a neat orderly manner, checked for computations and errors prior to turnover, along with a daily QC summary report.

**C.** Non-Destructive Seam Testing by GEOSYNTHETICS INSTALLER

1. The GEOSYNTHETICS INSTALLER shall non-destructively test field welds for continuity over their full length using vacuum test units or air pressure testing. The non-destructive testing shall be performed concurrently with seaming WORK progress, not at the completion of all seaming. Any defects located in the seam shall be repaired in accordance with Section 3.6. The following non-destructive testing procedures shall be used to test the field seams for continuity.
   a. Vacuum box testing for extrusion welds.
   b. Air pressure testing for double fusion seams.

2. Vacuum Box Testing
   a. The vacuum box testing equipment shall comprise the following.
      i. Rigid housing; transparent viewing window; a soft rubber gasket attached to bottom of housing; porthole or valve assembly; and a vacuum gauge.
      ii. A vacuum pump capable of applying 5 psi gage pressure of vacuum to the box.
      iii. A bucket of soapy solution and applicator.
   b. The procedure for vacuum testing is as follows:
i. Clean window, gasket surfaces, and check for leaks.

ii. Energize vacuum pump and reduce tank pressure to approximately 5 psi.

iii. Wet a strip of geomembrane approximately 12 inches by 30 inches (length of box) with soapy solution.

iv. Place box over wetted area and compress.

v. Close bleed valve and open vacuum valve.

vi. Ensure that a leak tight seal is created.

vii. Examine length of weld through viewing window for presence of soap bubbles for a period of not less than 10 seconds.

viii. If no bubbles appear after 10 seconds, close vacuum valve and open bleed valve, move box over next adjoining area with minimum three inches overlap and repeat process.

ix. Areas where soap bubbles appear will be marked by the CQA MANAGER with a defect code. The Installer shall then repair the area in accordance with Section 3.6 and retest the repaired area.

3. Air Pressure Testing (Double Fusion Seams Only)

a. The air pressure testing equipment shall comprise the following.

i. An air pump, equipped with pressure gauge with an accuracy of 1 psi, capable of generating and sustaining a pressure between 27 to 30 psi and mounted on a cushion to protect geomembrane.

ii. Rubber hose with fittings and connections.

iii. Sharp hollow needle or other pressure feed device approved by the CQA MANAGER.

b. To perform the test:

i. Seal both ends of the seam to be tested.

ii. Insert a needle or other approved pressure feed device into tunnel created by double hot wedge seaming and insert a protective cushion between air pump and geomembrane.

iii. Energize air pump to 27 to 30 psi, close valve, and sustain pressure for a minimum of five minutes.

iv. If loss of pressure exceeds 2 psi or does not stabilize, locate faulty area and repair in accordance with Section 3.6.

v. Release pressure at opposite end of seam from gauge to verify that the seam is not blocked.

vi. Remove approved pressure feed device and seal penetration holes by extrusion welding.

C. Destructive Seam Testing

1. For destructive seam testing, the CQA MANAGER shall be provided with a minimum of one sample per 1000 feet of seam length by each welding apparatus. The location will be selected by the CQA MANAGER and the GEOSYNTHETICS INSTALLER will not be informed of the sample location in advance. The GEOSYNTHETICS INSTALLER shall visually observe, mark and repair suspect welds before release of a section to the CQA MANAGER for destructive sample marking. Cut destructive samples as seaming and nondestructive testing progresses, prior to completion of liner installation. The CQA MANAGER will mark destructive samples with consecutive numbering, location, apparatus I.D., technician I.D., CQA MANAGER I.D., and apparatus settings and date. Record, in written form,
weld and test date, time, location, seam number, ambient temperatures, machine settings, technician I.D., apparatus I.D., and pass or fail description. The GEOSYNTHETICS INSTALLER shall immediately repair holes in geomembrane resulting from obtaining destructive samples and vacuum test patches. The size of destructive samples shall be 12 inches wide by 48 inches long with seam centered lengthwise.

2. Two 1-inch wide specimens shall be taken from each side of the sample and tested by the Installation GEOSYNTHETICS INSTALLER for peel and shear in the field prior to CQA destructive testing. If any of these specimens fail, the GEOSYNTHETICS INSTALLER shall track the failure immediately. The remaining sample shall be cut into three 14-inch long pieces and distributed as follows:
   a. To the CQA MANAGER for destructive testing.
   b. To the CQA MANAGER for archive.
   c. To the GEOSYNTHETICS INSTALLER for his/her use.

3. The GEOSYNTHETICS INSTALLER shall cut ten 1-inch wide specimens from one piece. Five specimens shall be tested for peel and five for shear strengths in accordance with the CQA Plan, with test results meeting the requirements of Table 31 05 19.16-4. CQA MANAGER AND/OR CQA MONITORS shall have access to use either of the GEOSYNTHETICS INSTALLER tensiometers. In the event of failure, the procedures for failed seam tracking are:
   a. Retrace welding path a minimum of 10 feet in both directions from the failed test location and remove (at these locations) a one inch wide specimen for testing. Repeat tracking procedures until the GEOSYNTHETICS INSTALLER is confident of seam quality.
   b. Obtain destructive samples from each side of the welding path and distribute, as described above, to the CQA MANAGER for destructive testing.
   c. Repeat process if additional tests fail.
   d. Reconstruct seam between passing test locations to satisfaction of the CQA MANAGER.
   e. Reconstruction may be one of the following:
      i. Cut out old seam, reposition panel and re-seam.
      ii. Add cap strip.
   f. Cut additional destructive samples from reconstruction at discretion of CQA MANAGER.
   g. If additional destructive sample results are not acceptable, repeat process until reconstructed seam is judged satisfactory by the CQA MANAGER.

D. For final seaming inspection, check the seams and surface of geomembrane for defects, holes, blisters, undispersed raw materials, or signs of contamination by foreign matter. Brush, blow, or wash geomembrane surface if dirt inhibits inspection. The CQA MANAGER shall decide if cleaning of geomembrane surface and welds is needed to facilitate inspection. Distinctively mark repair areas and indicate required type of repair.

3.6 REPAIR PROCEDURES FOR GEOSYNTHETICS INSTALLER

A. The geomembrane will be inspected before and after seaming for evidence of defects, holes, blisters, undispersed raw materials, and any sign of contamination by
foreign matter. The surface of the geomembrane shall be clean at the time of inspection. The geomembrane surface shall be swept or washed by the GEOSYNTHETICS INSTALLER if surface contamination inhibits inspection. The GEOSYNTHETICS INSTALLER shall ensure that an inspection of the geomembrane precedes any seaming of that section.

B. Remove damaged geomembrane and replace with acceptable geomembrane materials if damage cannot be satisfactorily repaired.

C. Repair, removal and replacement shall be at the GEOSYNTHETICS INSTALLER expense if the damage results from the GEOSYNTHETICS INSTALLER activities.

D. Fishmouths shall be slit, laid flat, and seamed with a minimum overlap of 3 inches. Any portion where the overlap is less than 3 inches shall be patched with an oval or round patch of geomembrane that extends a minimum of 6 inches beyond the cut in all directions.

E. Repair any portion of the geomembrane exhibiting a flaw, or failing a destructive or non-destructive test. The GEOSYNTHETICS INSTALLER shall be responsible for repair of damaged or defective areas. Agreement upon the appropriate repair method shall be decided between the CQA MANAGER and the GEOSYNTHETICS INSTALLER. Procedures available include:

1. Patching: Used to repair holes (over 1/4-inch diameter), tears (over 1/4 inch long), undispersed raw materials, and contamination by foreign matter.
2. Grinding and welding: Used to repair pinholes, blemishes and over-grinding.
4. Removing the seam and replacing with a strip of new material.

F. In addition, the following procedures shall be observed.

1. Geomembrane surfaces to be repaired shall be abraded (extrusion welds only) no more than 1/2 hour prior to the repair.
2. All geomembrane surfaces shall be clean and dry at the time of repair.
3. The repair procedures, materials, and techniques shall be approved in advance of the specific repair by the CQA MANAGER.
4. Extend patches or caps at least 6 inches beyond the edge of the defect, i.e., patch or cap shall be a minimum of 12 inches in diameter, and round all corners of material to be patched.
5. Bevel the edge of the patch and do not cut patch with repair sheet in contact with geomembrane. Temporary bond the patch to the geomembrane with an approved method, extrusion weld the patch and then vacuum test the repair.
6. All panel intersections (T-seams) shall be repaired with a patch.

G. Repair Verification:

1. Number and log each patch repair (performed by the CQA MANAGER).
2. Non-destructively test each repair using methods specified in this Section.
3. Provide daily documentation of non-destructive and destructive testing to the CQA MANAGER. The documentation shall identify seams that initially failed the test and include the evidence that these seams were repaired and retested successfully.
3.7 ACCEPTANCE

A. The GEOSYNTHETICS INSTALLER shall retain ownership and responsibility for the geomembrane until acceptance by the OWNER.

B. Acceptance Criteria: The following shall be completed:
   1. Verification of adequacy of field seams, repairs and testing by the CQA MANAGER including leak survey.
   2. All submittals.
   3. As-buil t drawings, approved and final drawings submitted.
   4. Construction area cleaned.
   5. Final field inspection
   6. Warranty signed over to the OWNER.

C. Field Inspections: Inspect the completed Work with the CQA MANAGER; defects, wrinkles, suspicious looking welds shall be noted and marked; document, correct and arrange further field inspections until no corrective action is necessary.

3.8 CONFORMANCE TESTING

A. Material will be made available to the CQA MANAGER by the GEOSYNTHETICS MANUFACTURER upon notice to proceed for conformance sampling and testing at a minimum frequency of one per 100,000 square feet of material continuously produced and supplied to the project, with a minimum of one sample per production lot. Materials may be sampled at the plant at the option of the OWNER.

B. As a minimum, the following tests will be performed by a geosynthetics CQA laboratory and shall meet the requirements outlined in Table 31 05 19.16-1.
   1. Thickness (ASTM D5994)
   2. Specific Gravity (ASTM D1505)
   3. Carbon Black Content (ASTM D1603)
   4. Carbon Black Dispersion (ASTM D5596)
   5. Tensile Properties (ASTM D638)
   6. Puncture Resistance (ASTM D4833)
   7. Asperity Height (GRI GM 12)

C. If a test result is in non-conformance with the SPECIFICATIONS, all material from that production lot represented by the failed test shall be rejected. Rejected material may be minimized by bounding the nonconformance material with additional passing tests conducted by the geosynthetics CQA laboratory. Additional tests shall be conducted by the GEOSYNTHETICS MANUFACTURER at no additional cost to the OWNER.

D. Rejected material shall be replaced at no additional cost to OWNER.

3.9 ANCHOR TRENCH

A. The CONTRACTOR shall excavate the anchor trenches to the lines, grades, and width shown in the DRAWINGS, prior to any geosynthetic material placement. CQA MANAGER shall verify that the anchor trench has been constructed according to the DRAWINGS.
B. The anchor trench shall be backfilled and compacted as approved by the CQA MANAGER. Trench backfill material shall be placed in 9 to 12-inch thick loose lifts and compacted by wheel rolling with light, rubber-tired or other light compaction equipment, as approved by CQA MANAGER.

C. Care shall be taken when backfilling the trenches to prevent any damage to the geosynthetic materials. At no time shall construction equipment come into direct contact with the geosynthetic materials. If damage occurs, it shall be repaired by the GEOSYNTHETICS INSTALLER prior to the completion of backfilling, at no cost to OWNER.

D. CONTRACTOR shall extend geosynthetic materials into the anchor trench as shown in the DRAWINGS. The geosynthetic materials shall be seamed, bonded, or attached along the entire distance of the anchor trench, using approved methods described in this Section.

3.10 PLACEMENT OF SOIL OR GRANULAR MATERIALS

A. All soil materials located on top of a geomembrane shall be placed by the CONTRACTOR in such a manner as to ensure:
   1. The geomembrane and any underlying geosynthetic material is not damaged.
   2. Minimal slippage of the geomembrane on underlying layers occurs.
   3. Minimal movement and wrinkling or folding of the underlying geosynthetic layer(s) occurs.
   4. No excess tensile stresses shall occur in the geomembrane, such as by earth moving equipment making sudden starts, stops, or turns. The allowable ground pressure for equipment shall be prescribed by CQA MANAGER for the material type and layer thickness.

3.11 SURVEY CONTROL

A. CQA MANAGER will perform survey of final surface area of geosynthetics to determine quantities for payment purposes.

B. GEOSYNTHETICS INSTALLER shall provide CONTRACTOR and CQA MANAGER with record drawings of geomembrane panel locations and extent of the geomembrane. Drawings shall be submitted in both electronic and hardcopy format.

***END OF SECTION***
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. This Section includes requirements for the manufacture, supply, and installation of geocomposite for the project and the construction CQA monitoring and testing. All procedures, operations, and methods shall be in strict compliance with the Specifications, CQA Plan, and the Drawings.

1.2 REFERENCES

A. ASTM D1238 – Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
D. ASTM D4716-00 – Standard Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
E. ASTM D5199 - Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes

1.3 SUBMITTALS

A. Contractor shall provide the following information after contract award but at a minimum fourteen (14) days prior to shipping of geocomposite for review and approval by CQA MANAGER:
   1. Information from Manufacturer including company name, address, telephone number, the names of the company president and QC manager, and narrative of the company history.
   2. A list of standard material properties and test methods employed to arrive at the values for each. As a minimum, the list shall include properties given in Part 2.1 of this Section.
   3. The QC Manual followed during the manufacturing process including those for the polymer material and for detecting foreign objects in the finished goods, and a description of the QC laboratory facilities, including the name and telephone number of the QC manager.

B. Contractor shall submit the following geocomposite Manufacturer’s documentation on the raw materials used to manufacture the geocomposite:
1. QC certificates issued by the raw material supplier including the production dates of the raw material used to manufacture the geocomposite for the project.

2. Results of tests conducted by the geocomposite Manufacturer to verify the quality of the resin used to manufacture the geonet assigned to the project and the origin of the resin and QC certificates issued by the resin supplier.

3. Certification that no reclaimed polymer was used in the manufacturing of the geonet to be used for the project.

C. A copy of the Geocomposite Manufacturer’s QC Program.

D. QC certificates for test results at the sampling frequency indicated by the Manufacturer’s QC Plan shall be submitted. The CQA MANAGER reserves the right to refuse use of any geocomposite supplied without the proper QC documentation.

1. Manufacturing QC certificates for each shift’s production shall be signed by responsible parties employed by the Manufacturer (such as the Production Manager).

2. The QC certificates shall include:
   a. Roll numbers and identification
   b. Sampling procedures
   c. Results of the QC tests verifying each of the properties listed in Part 2.1 of this Section
   d. Transmissivity tests do not need to be completed as routine QC tests. However, Manufacturer shall include a written statement that the product has been tested and meets or exceeds the transmissivity requirements. Tests results shall be included
   e. A detailed list of performance criteria for the geocomposite material being produced for this project. (Note: Performance criteria are sometimes referred to as “minimum property values.” Refer to Part 2.1 of this Section for geocomposite properties and test methods.)

1.4 QUALITY ASSURANCE

A. All work shall be constructed, monitored, and tested in accordance with the Manufacturer’s CQA plan. The Contractor and Manufacturer shall participate and comply with all items in these specifications and requirements of the CQA plan.

B. Contractor shall ensure that geocomposite Manufacturer has an internal product QC program that meets Contract requirements.

C. Contractor shall be aware of all activities outlined in the CQA plan, and Contractor shall account for these activities in the construction schedule.

D. The Contractor will provide required QC information at least fourteen (14) days prior to geosynthetics being shipped to the project for review and approval by the Construction Manager and/or Engineer. Contractor shall also assure that the geocomposite is delivered to the site at least five (5) calendar days prior to installation. Conformance testing must be completed, reviewed, and approved by the Construction Manager and/or Engineer prior to shipping of geocomposite to the site.
E. Geocomposite that does not meet the requirements of this specification and the Manufacturer’s CQA plan shall be rejected. Contractor shall be required to replace the rejected material with new material that complies with the specifications.

F. In order to prevent weather damaged geocomposite from being placed, the following QA procedures shall be followed:
   1. Contractor shall perform its work and utilize sufficient ballast as necessary to prevent wind uplift of the geocomposite.
   2. If weather damage should occur, Construction Manager shall determine if the geocomposite shall be repaired or replaced. Weather damage to the geocomposite will include tears and dirty fabric, as determined by the Construction Manager or CQA Monitor.
   3. Repair or replacement of the weather-damaged geocomposite shall be completed by Contractor.

G. Conformance Testing
   1. During manufacturing of the geocomposite, the CQA Monitor will facilitate the collection of samples to the QA Testing Laboratory for testing to ensure conformance with the specifications.
   2. Samples will be taken across the entire width of the roll and shall not include the first 3 ft. Unless otherwise stated, samples will be 3 ft long by the width of the roll. The CQA Monitor will mark the machine direction on the samples with an arrow.
   3. Conformance testing must be completed, reviewed, and approved by Construction Manager or Engineer prior to shipping of geocomposite to the site. Conformance samples shall be collected at the frequencies defined in the CQA Plan. Tests will be performed on the geocomposite to verify conformance to the design specifications with minimum values specified in Part 2.1 of this Section.
   4. If a test result is in nonconformance with the specifications, all material from that production lot presented by the failed test shall be rejected. Rejected material may be minimized by bounding the nonconformance material with additional passing tests conducted by the geosynthetic CQA laboratory.
   5. Rejected material shall be replaced.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping
   1. Geocomposite shall be supplied in rolls wrapped in relatively impermeable and opaque protective covers, with straps for unloading.
   2. Geocomposite rolls shall be marked or tagged with the following information.
      a. Manufacturer’s name
      b. Product information
      c. Roll number
      d. Batch or lot number
      e. Roll dimensions
   3. Contractor shall ensure that geocomposite rolls are properly loaded and secured to prevent damage during transit.
4. Contractor shall protect geocomposite from excessive heat, cold, puncture, cutting, or other damaging or deleterious conditions.
5. Contractor shall ensure personnel responsible for loading, transport, and unloading of geocomposite are familiar with handling and transport constraints imposed by Manufacturer.

B. Acceptance at Site
1. CQA Monitor shall perform inventory and surface inspection for defects and damage of all geocomposite rolls upon delivery.
2. Contractor shall unroll and inspect any geocomposite roll that may be damaged below surface layers.
3. Contractor shall repair damage resulting from handling and transport of geocomposite. If irreparable, in the opinion of CQA Monitor, damaged materials shall be replaced.

C. Storage and Protection
1. Manager shall provide on-site storage area for geocomposite rolls from time of delivery until installation.
2. The storage of the materials is the responsibility of Contractor from the time the materials are off-loaded until the time the completed installation is accepted. Contractor is responsible for preparing the storage location, off the ground, and for the protection of the material from the elements (e.g., ultraviolet light, moisture, temperature, etc.).
3. After Contractor has removed material from storage area, protect geocomposite from puncture, dirt, groundwater, moisture, mud, mechanical abrasion, excessive heat, ultraviolet light exposure, and other sources of damage.
4. Geocomposite rolls shall be stored in relatively opaque and watertight wrappings.
5. Contractor shall preserve integrity and readability of the geocomposite roll labels, and store such that Construction Manager shall have access to the package slips or roll labels for each roll to verify roll acceptance.

1.6 WARRANTY
A. Special Warranty: Manufacturer’s standard form in which Manufacturer agrees to repair or replace components of equipment that fails in materials or workmanship within specified warranty period.

1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS
A. Geocomposite shall be high-density polyethylene (HDPE) and manufactured by extruding two crossing strands to form a bi-planer drainage net structure with a non-woven geotextile bonded to both sides.

B. The geonet shall be comprised of a minimum 95 percent pure polyethylene. The remaining portion shall be made up of materials necessary for the performance of the geonet (such as carbon black, anti-oxidants, etc.).
C. The geocomposite used for the work shall meet or exceed (unless noted otherwise) the minimum properties listed in the Table 31 05 19.25-1 for an 8oz/sy geocomposite:
### TABLE 31 05 19.22-1
**GEOCOMPOSITE PROPERTIES**

<table>
<thead>
<tr>
<th>Geocomposite</th>
<th>Tested Property</th>
<th>Test Method</th>
<th>Frequency</th>
<th>Minimum Average Roll Value&lt;sup&gt;ad&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>6 oz/yd&lt;sup&gt;2&lt;/sup&gt;</td>
<td>8 oz/yd&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td>Product Code</td>
<td>Transmissivity&lt;sup&gt;a&lt;/sup&gt;, gal/min/ft (m³/sec)</td>
<td>ASTM D 4716</td>
<td>1/540,000 ft&lt;sup&gt;2&lt;/sup&gt;</td>
<td>0.48 (1 x 10⁻¹)</td>
</tr>
<tr>
<td></td>
<td>Ply Adhesion, lb/in (g/cm)</td>
<td>ASTM D 7005</td>
<td>1/50,000 ft&lt;sup&gt;2&lt;/sup&gt;</td>
<td>1.0 (178)</td>
</tr>
<tr>
<td></td>
<td>Roll Width&lt;sup&gt;b&lt;/sup&gt;, ft (m)</td>
<td></td>
<td>14.5 (4.4)</td>
<td>14.5 (4.4)</td>
</tr>
<tr>
<td></td>
<td>Roll Length&lt;sup&gt;c&lt;/sup&gt;, ft (m)</td>
<td></td>
<td>230 (70.1)</td>
<td>200 (60.9)</td>
</tr>
<tr>
<td></td>
<td>Roll Area, ft&lt;sup&gt;2&lt;/sup&gt; (m²)</td>
<td></td>
<td>3,335 (310)</td>
<td>2,900 (269)</td>
</tr>
</tbody>
</table>

#### Geonet core<sup>ad</sup>

<table>
<thead>
<tr>
<th>Geocomposite</th>
<th>Transmissivity&lt;sup&gt;a&lt;/sup&gt;, gal/min/ft (m³/sec)</th>
<th>ASTM D 4716</th>
<th>9.66 (2 x 10⁻¹)</th>
<th>9.66 (2 x 10⁻¹)</th>
<th>9.66 (2 x 10⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Thickness, mil (mm)</td>
<td>ASTM D 5199</td>
<td>1/50,000 ft&lt;sup&gt;2&lt;/sup&gt;</td>
<td>200 (5)</td>
<td>200 (5)</td>
</tr>
<tr>
<td></td>
<td>Density, g/cm&lt;sup&gt;3&lt;/sup&gt;</td>
<td>ASTM D 1505</td>
<td>1/50,000 ft&lt;sup&gt;2&lt;/sup&gt;</td>
<td>0.94</td>
<td>0.94</td>
</tr>
<tr>
<td></td>
<td>Tensile Strength (MD), lb/in (N/mm)</td>
<td>ASTM D 5035</td>
<td>1/50,000 ft&lt;sup&gt;2&lt;/sup&gt;</td>
<td>45 (7.9)</td>
<td>45 (7.9)</td>
</tr>
<tr>
<td></td>
<td>Carbon Black Content, %</td>
<td>ASTM D 1603</td>
<td>1/50,000 ft&lt;sup&gt;2&lt;/sup&gt;</td>
<td>2.0</td>
<td>2.0</td>
</tr>
</tbody>
</table>

#### Geotextile (prior to lamination)<sup>ad</sup>:

<table>
<thead>
<tr>
<th>Geocomposite</th>
<th>Mass per Unit Area, oz/yd&lt;sup&gt;2&lt;/sup&gt; (g/m&lt;sup&gt;2&lt;/sup&gt;)</th>
<th>ASTM D 5261</th>
<th>1/90,000 ft&lt;sup&gt;2&lt;/sup&gt;</th>
<th>6 (200)</th>
<th>8 (270)</th>
<th>10 (335)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Grab Tensile, lb (N)</td>
<td>ASTM D 4632</td>
<td>1/90,000 ft&lt;sup&gt;2&lt;/sup&gt;</td>
<td>170 (755)</td>
<td>220 (975)</td>
<td>260 (1,155)</td>
</tr>
<tr>
<td></td>
<td>Puncture Strength, lb (N)</td>
<td>ASTM D 4833</td>
<td>1/90,000 ft&lt;sup&gt;2&lt;/sup&gt;</td>
<td>90 (395)</td>
<td>120 (525)</td>
<td>165 (725)</td>
</tr>
<tr>
<td></td>
<td>AOS, US sieve (mm)</td>
<td>ASTM D 4751</td>
<td>1/540,000 ft&lt;sup&gt;2&lt;/sup&gt;</td>
<td>70 (0.212)</td>
<td>80 (0.180)</td>
<td>100 (0.350)</td>
</tr>
<tr>
<td></td>
<td>Permittivity, sec&lt;sup&gt;−1&lt;/sup&gt;</td>
<td>ASTM D 4491</td>
<td>1/540,000 ft&lt;sup&gt;2&lt;/sup&gt;</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>Flow Rate, gpm/ft (lpm/m&lt;sup&gt;2&lt;/sup&gt;)</td>
<td>ASTM D 4491</td>
<td>1/540,000 ft&lt;sup&gt;2&lt;/sup&gt;</td>
<td>110 (4,480)</td>
<td>110 (4,480)</td>
<td>85 (3,460)</td>
</tr>
<tr>
<td></td>
<td>UV Resistance, % retained</td>
<td>ASTM D 4355 (after 500 hours)</td>
<td>once per formulation</td>
<td>70</td>
<td>70</td>
<td>70</td>
</tr>
</tbody>
</table>

**NOTES:**
- <sup>a</sup>These are MARV values that are based on the cumulative results of specimens tested and determined by GSE. AOS in mm is a maximum average roll value.
- <sup>b</sup>Gradient of 0.1, normal load of 10,000 psi, water at 70° F between steel plates for 15 minutes.
- <sup>c</sup>Roll widths and lengths have a tolerance of ±1%.
- <sup>d</sup>Component properties prior to lamination.

**PART 3 - EXECUTION**

### 3.1 INSTALLATION

A. The geocomposite shall be installed in accordance with the Manufacturer’s recommended procedures.

B. The CQA Monitor shall verify that all geocomposite rolls and underlying layers are free from deleterious material or debris prior to deployment.

C. The geocomposite panels shall be positioned to minimize wrinkles.

D. No personnel working on the geocomposite shall smoke, wear damaging shoes, or engage in other activities that could damage the geocomposite. No equipment or tools shall damage the geocomposite by handling, trafficking, or other means.

E. The Contractor is responsible for anchoring exposed geocomposite to protect against wind damage until subsequent layers are placed.
F. The geocomposite shall only be cut utilizing methods and tools (i.e., a hooked utility blade) which will not damage the geocomposite or other previous work.

G. Each component of the geocomposite will be secured or seamed to the like component at overlaps.

H. Geocomposite components
1. Adjacent edges of the geonet along the length of the geocomposite roll shall be placed with the edges of each geonet butted against each other.
2. The overlaps shall be joined by tying the geonet structure with cable ties. These ties shall be spaced every five (5) feet along the roll length.
3. Adjoining geocomposite rolls (end to end) across the roll width should be shingled down in the direction of the slope, with the geonet portion on the top overlapping the geonet portion of the bottom geocomposite a minimum of 12-inches across the roll width. The geonet portion on end-to-end seams shall be tied every 6 inches.

I. During placement of geocomposite, care shall be taken not to entrap stones, excessive dust, or moisture that could damage the underlying or overlying geosynthetics, or cause clogging of drains or filters.

J. Following the installation of all geocomposite, an examination of the entire surface shall be conducted to detect potentially harmful foreign objects. Any such foreign objects found shall be removed or the panel shall be replaced by the Contractor.

K. The Contractor shall be responsible for field handling, storing, deploying, seaming, or joining, temporary restraining (against wind), anchoring, and other aspects of geocomposite installation.

L. The Contractor shall accept and retain full responsibility for all materials and installation and shall be held responsible for any defects in the completed systems.

3.2 FIELD QUALITY CONTROL

A. Field inspection and testing shall be performed in accordance with the CQA plan and as indicated in the Contract Documents. The GEOSYNTHETICS INSTALLER shall designate a full-time QC technician who shall be responsible for supervising and/or conducting the field QC program. The QC technician may not be replaced without written authorization by the Manager.

3.3 PROTECTION

A. The Contractor shall place all soil materials in such a manner as to ensure that:
1. The geocomposite and underlying materials are not damaged
2. Minimal slippage occurs between the geocomposite and the underlying geosynthetic layers
3. Excess tensile stresses are not developed in the geocomposite, such as by earth moving equipment making sudden sharp starts, stops, or turns.
allowable ground pressure for equipment shall be prescribed by CQA MANAGER for the material type and layer thickness

4. Minimal movement and wrinkling or folding of the underlying geosynthetic layer occurs

3.4 REPAIRS

A. Any defects observed in the geocomposite shall be brought to the attention of the CQA MANAGER.

B. Any defects in the geocomposite shall be repaired per the Manufacturer's specifications as approved by the CQA MANAGER.

C. Holes or tears in the geocomposite shall be removed and patched. The patch shall be secured to the original geonet by tying every 6 inches with the approved tying devices. If the area to be repaired is more than 50 percent of the width of the panel, the damaged area shall be cut out and the two portions of the geonet shall be cut out and the two portions of the geonet shall be joined in accordance with end-to-end seaming.

**END OF SECTION**
PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope
1. This section describes the general requirements for the manufacture, supply, installation, and quality control of the geosynthetic clay liner (GCL) associated with the Work.
2. The GCL will be procured directly by the OWNER from the GEOSYNTHETICS MANUFACTURER. The CONTRACTOR shall be responsible for unloading and storing the GCL prior to installation. All GCL shall be installed by the GEOSYNTHETICS INSTALLER.

B. Related Sections
1. Section 31 05 19.13 Geotextiles for Earthwork
2. Section 31 05 19.16 Geomembranes for Earthwork
3. Section 31 23 00 Excavation and Fill

1.2 REFERENCES

A. Latest Version of American Society for Testing and Materials (ASTM) standards:
1. ASTM D4632 Standard Test Method for Breaking Load and Elongation of Geotextiles (Grab Method)
2. ASTM D5084 Standard Test Method of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
3. ASTM D5261 Standard Test Method for Measuring Mass Per Unit Area of Geotextiles
4. ASTM D6243 Determining the Internal & Interface Shear Strength of Geosynthetic Clay Liner by the Direct Shear Method
5. ASTM D5887 Standard Test Method for Measurement of Index Flux Through Saturated GCL Specimens Using a Flexible Wall Permeameter
6. ASTM D5888 Standard Guide for Storage and Handling of GCLs
9. ASTM D5993 Standard Test Method for Mass Per Unit Area of GCLs
10. ASTM D6072 Standard Guide for Installation of GCLs

B. GRI GCL-3 Standard Test Method for GCL Overlap Seam Permeability

1.3 PRE-QUALIFICATION

A. The GEOSYNTHETICS INSTALLER shall pre-qualify for geosynthetic installation by providing the following qualification documentation:
1. The GEOSYNTHETICS INSTALLER shall have a minimum of 10,000,000 square feet (sf) of HDPE geosynthetic cumulative installation experience.
2. The GEOSYNTHETICS INSTALLER shall provide at least three references from prior installation projects in excess of 500,000 sf including the following information:
   a. Client’s name, address, phone number and contact or representatives name.
   b. Project site and description.
   c. Geosynthetic type(s) and quantity installed.

1.4 SUBMITTALS

A. GEOSYNTHETICS MANUFACTURER shall submit to the CQA MANAGER the following information relating to the GCL a minimum of fourteen (14) calendar days prior to shipment to the site:
   1. Quality Control Program:
      a. Certificates issued by the raw material supplier including the production dates of the raw material used to manufacture the geosynthetic clay liner.
      b. Certificates for each shift’s production of GCL, and statements of production dates.
      c. The quality control certificates shall include:
         i. Roll numbers and identification;
         ii. Sampling procedures; and
         iii. Results of quality control tests, including descriptions of the test methods used.
      d. The results of the manufacturing quality control tests shall meet or exceed the property values listed in Table 31 05 19.23-1.

B. Prior to mobilization of the GEOSYNTHETICS INSTALLER to the Site, the GEOSYNTHETICS INSTALLER shall submit the following:
   1. Shop drawings indicating panel layout and field seams. Each panel shall be assigned an identification number.
   2. Installation schedule.
   3. Copy of GEOSYNTHETICS INSTALLER letter of approval or license by the GEOSYNTHETICS MANUFACTURER.
   4. Proposed installation capabilities, including:
      a. Information on equipment proposed for this project;
      b. Average daily production anticipated for this project; and
      c. Quality control procedures.
   5. Resume of the superintendent and Quality Control Inspector for GEOSYNTHETICS INSTALLER to be assigned to this project, including dates and duration of employment. Substitution of these key personnel, without prior notification and approval by CQA MANAGER will be sufficient grounds for removal of GEOSYNTHETICS INSTALLER from the Project.
   6. Resumes of all GEOSYNTHETICS INSTALLER personnel who will perform seaming operations on this project, including dates and duration of employment.

C. Immediately upon Notice of Award, CONTRACTOR shall make available to the CQA MANAGER samples of the GCL for interface shear testing and conformance testing.
D. During the installation, the GEOSYNTHETICS INSTALLER shall be responsible for the timely submission to the CQA MANAGER of subgrade acceptance certificates, signed by the GEOSYNTHETICS INSTALLER and CONTRACTOR, for each area to be covered by geosynthetic clay liner and geomembrane.

1.5 QUALITY ASSURANCE

A. All Work shall be constructed, monitored, and tested in accordance with the CQA Manual. The CONTRACTOR, GEOSYNTHETICS INSTALLER and GEOSYNTHETICS MANUFACTURER shall participate and comply with all items in the CQA Manual.

B. GEOSYNTHETICS INSTALLER shall attend a pre-installation conference. Attendance of parties directly affecting the WORK of this Section will be mandatory.

C. Conformance Testing
   1. Material shall be made available to the CQA MANAGER after notice to proceed for sampling and conformance testing by the CQA MANAGER at a minimum frequency of one per 100,000 sf of geosynthetic clay liner continuously produced and supplied to the project with a minimum of one sample per lot.
   2. If a test result is in non-conformance with the Specifications, all material from that production lot represented by the failed test shall be rejected. Rejected material may be minimized by bounding the non-conformance material with additional passing tests conducted by the geosynthetic CQA laboratory. Additional tests and replaced material will be provided at no additional cost to the OWNER. No material shall be shipped until confirmation from the CQA MANAGER that samples have passed conformance testing.

1.6 DELIVERY, STORAGE, AND HANDLING

A. CONTRACTOR and GEOSYNTHETICS INSTALLER shall conform to the Manufacturer's requirements to prevent damage to GCL.

B. Transportation of GCL by the GEOSYNTHETICS MANUFACTURER shall be through an independent trucking firm and shall be shipped via a closed or flatbed trailer.

C. Offloading and storage of the GCL shall be the responsibility of the CONTRACTOR. Handling and care of the GCL after acceptance by the CQA MANAGER, prior to and following installation, will be the responsibility of the GEOSYNTHETICS INSTALLER, until Final Acceptance of the liner system by the CQA MANAGER.

D. Delivery:
   1. GEOSYNTHETICS MANUFACTURER shall deliver materials to the site only after the CQA MANAGER approves the required submittals.
   2. All rolls of GCL delivered to the site shall be identified by the GEOSYNTHETICS MANUFACTURER at the factory with the following:
      a. Manufacturer’s name
      b. Product identification
      c. Lot number
      d. Roll number
e. Roll dimensions

3. CQA MANAGER and CONTRACTOR must be present when GCL is delivered to the site. GEOSYNTHETICS MANUFACTURER shall notify CQA MANAGER a minimum of 2 business days prior to delivery.

4. CONTRACTOR is responsible for separating damaged rolls from undamaged rolls and storing at locations designated by the CQA MANAGER until proper disposition of material is determined by the OWNER and the CQA MANAGER.

5. The OWNER will be the final authority regarding damage.

6. CONTRACTOR shall separate rolls without proper documentation and store until the CQA MANAGER approval is received. Rolls or pallets without proper identification by GEOSYNTHETICS MANUFACTURER shall be subject to rejection.

E. On-site Storage:
   1. CONTRACTOR shall store in space allocated by the OWNER.
   2. Protect from puncture, dirt, grease, water, moisture, mud, mechanical abrasions, excessive heat or other damage.
   3. Store on level prepared surface (not on wooden pallets).
   4. Stack per Manufacturer’s recommendation but no more than three rolls high.
   5. CONTRACTOR shall preserve integrity and readability of the GCL roll labels, and store such that CQA MANAGER shall have access to the package slips or roll labels for each roll to verify roll acceptance.

F. On-site Handling:
   1. GEOSYNTHETICS INSTALLER shall use appropriate handling equipment to load, move or deploy GCL rolls. Appropriate handling equipment includes cloth chokers and spreader bar for loading, spreader and roll bars for deployment. Dragging panels on ground surface will not be permitted.
   2. GEOSYNTHETICS INSTALLER shall not fold GCL material; folded material shall be rejected.

G. Damaged GCL:
   1. GCL damage will be documented by the CQA MANAGER.
   2. GCL found damaged upon arrival at the site shall be replaced by the GEOSYNTHETICS MANUFACTURER at no additional cost to the OWNER.

PART 2 - PRODUCTS

2.1 GEOSYNTHETIC CLAY LINER

A. The geosynthetic clay liner shall be GSE BentoLiner NWL, as manufactured by GSE Environmental, or ENGINEER-approved equal. The geosynthetic clay liner shall be formulated and manufactured from polypropylene geotextiles and high swelling, polymer-enhanced granular sodium bentonite.

B. Specifications for GCL properties are presented in Table 31 05 19.23-1 below. Supplied material shall conform to these properties based upon the Manufacturer’s QC testing and CQA conformance testing.
### TABLE 31 05 19.23-1

GCL PROPERTIES

<table>
<thead>
<tr>
<th>Property</th>
<th>Units</th>
<th>Test Method</th>
<th>Value</th>
<th>Minimum Manufacturer QC Test Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Geotextile Properties</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Cap Nonwoven, Mass/Unit Area</td>
<td>oz/yd²</td>
<td>ASTM D5261</td>
<td>6 (min. avg.)</td>
<td>25,000 yd²</td>
</tr>
<tr>
<td>2. Scrim Nonwoven, Mass/Unit Area</td>
<td>oz/yd²</td>
<td>ASTM D5261</td>
<td>6 (min. avg.)</td>
<td>25,000 yd²</td>
</tr>
<tr>
<td><strong>Bentonite Properties</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Swell Index</td>
<td>ml/2 g</td>
<td>ASTM D5890</td>
<td>24</td>
<td>50 tons</td>
</tr>
<tr>
<td>2. Fluid Loss</td>
<td>ml</td>
<td>ASTM D5891</td>
<td>18</td>
<td>50 tons</td>
</tr>
<tr>
<td><strong>Finished GCL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Bentonite, Mass/Unit Area¹</td>
<td>lb/ft²</td>
<td>ASTM D5993</td>
<td>0.75 (min. avg.)</td>
<td>5,000 yd²</td>
</tr>
<tr>
<td>2. Tensile Strength²</td>
<td>lb/in</td>
<td>ASTM D6768</td>
<td>45 (min. avg.)</td>
<td>25,000 yd²</td>
</tr>
<tr>
<td>3. Peel Strength</td>
<td>lb/in</td>
<td>ASTM D6496</td>
<td>3.5 (min. avg.)</td>
<td>5,000 yd²</td>
</tr>
<tr>
<td>4. Hydraulic Conductivity³</td>
<td>cm/sec</td>
<td>ASTM D5887</td>
<td>5x10⁻⁹ (max.)</td>
<td>30,000 yd²</td>
</tr>
<tr>
<td>5. Index Flux</td>
<td>m³/m²/sec</td>
<td>ASTM D5887</td>
<td>1x10⁻⁸ (max.)</td>
<td>30,000 yd²</td>
</tr>
</tbody>
</table>

**Notes:**
1. At 0% moisture content.
2. Tested in machine direction.
3. Deaired, deionized water @ 5 psi maximum effective confining stress and 2 psi head pressure.

C. The GCL shall be manufactured by mechanically bonding the geotextiles using a needlepunching process to enhance frictional and internal shear strength characteristics. No glues or adhesives shall be used in lieu of the needlepunch process.

D. The needlepunched GCL shall thermally heat set the nonwoven fibers where they protrude from the second geotextile to more permanently secure the reinforcement in place. Other means may be used to lock the fibers in place if the process demonstrates similar performance to the thermal heat set process.

E. No disassociation of geotextile components from the bentonite core shall occur. A sample of the bentonite GCL placed in 70° F tap water for 1 hour shall not delaminate.

F. A minimum overlap guide-line and a construction match-line delineating the overlap zone shall be imprinted with non-toxic ink on both edges of the GCL panel to ensure the accuracy of the seam.

**PART 3 – EXECUTION**

**3.1 SUBGRADE ACCEPTANCE**

A. The GEOSYNTHETICS INSTALLER, on a daily basis, shall certify in writing that the surface on which the GCL will be installed is acceptable. It will be the CONTRACTOR’S responsibility to maintain, protect, and, if required, return the...
subgrade in the condition that was originally accepted prior to GCL deployment until accepted by the CQA ENGINEER and GEOSYNTHETICS INSTALLER.

3.2 ANCHOR TRENCH

A. The CONTRACTOR shall excavate anchor trenches to the lines, grades, and widths shown on the drawings, prior to GCL placement. The CQA ENGINEER shall verify that the anchor trench has been constructed according to the Contract Drawings.

B. Slightly rounded corners shall be provided in the trench where the GCL adjoins the trench so as to avoid sharp bends in the GCL.

C. Care shall be taken when backfilling the trenches to prevent any damage to the GCL. At no time shall construction equipment come into direct contact with the GCL. If damage occurs, it shall be repaired by the Installer prior to the completion of backfilling.

D. Extend GCL into the anchor trench as shown in the Contract Drawings. The GCL shall be seamed along the entire distance of the anchor trench to the termination of the GCL panel, using approved methods described in this Section.

3.3 GCL DEPLOYMENT AND SEAMING

A. GCL panels shall be pulled from the roll suspended at the crest of the slope.

B. The GCL shall be overlapped in accordance with the GEOSYNTHETICS MANUFACTURER’s recommended procedures. As a minimum, the overlap shall be 12 inches along the length of the geosynthetic clay liner panel and 18 inches along the width of the geosynthetic clay liner panel on side slopes. As a minimum, the overlap shall be 6 inches along the length of the geosynthetic clay liner panel and 12 inches along the width of the geosynthetic clay liner panel on floor.

C. Displaced panels shall be adjusted to the correct position and orientation. The adjusted panel shall then be inspected for any geotextile damage or bentonite loss. Damage shall be repaired by the above procedure.

D. Place only as much GCL each day as can be covered with HDPE geomembrane liner. The GCL shall be covered by HDPE geomembrane liner at the end of each working day.

E. GCL shall be deployed so that panel seams are parallel to the dip of the slope.

F. Seams shall be perpendicular to toe of slope at all times.

G. Seams at the base of the slope shall be a minimum of 5 feet from the toe.

H. Seams shall be augmented with granular bentonite per the GEOSYNTHETICS MANUFACTURER’s recommendations to ensure seam integrity. Granular bentonite shall be dispersed evenly from the panel edge to the lap line at a minimum rate of ¼ pound per lineal foot continuously along all seams of overlap area. Accessory bentonite shall be of the same type of material used in the production of the geosynthetic clay liner itself.
I. In the event a roll end seam or joint cannot be avoided and occurs on a slope (>10%), construction adhesive shall be used in the lap area with the overlap increased to 24 inches in a rainflap (shingled) orientation.

J. Do not drag textured geomembranes across previously installed GCL. Use a smooth rub sheet between the GCL and the geomembrane, or other methods, to prevent damage. Remove rub sheet when geomembrane is in position.

K. The geosynthetic clay liner materials shall not be allowed to become wetted (except by the subgrade) prior to the placement of the geomembrane. All hydrated GCL shall be removed and replaced by the GEOSYNTHETICS INSTALLER at no additional cost to the OWNER.

L. For all penetrations in the geosynthetic clay liner, a small notch (approximately 3 inches wide and 8 inches deep) shall be cut along the edge of the area. The liner shall be brought up to the appurtenance and trimmed to fit into the notch. The GEOSYNTHETICS INSTALLER shall then hand apply pure bead of bentonite, or compact a mixture of 1 part bentonite to 4 parts soil (by volume), blended dry, into half of the notch. The liner shall then be inserted into the notch, with the remaining area in the notch refilled with the pure bentonite or the 1 to 4 mixture and compacted.

M. To avoid sharp bends in the geosynthetic clay liner, bevel the leading edges of the anchor trench.

3.4 GCL REPAIR

A. Prior to cover material placement, damage to the GCL shall be identified and repaired by the GEOSYNTHETICS INSTALLER. Damage is defined as any rips or tears in the geotextiles, delamination of geotextiles or a displaced panel.

B. Rips or tears may be repaired by completely exposing the affected area, removing all foreign objects or soil, and by then placing a patch cut from unused GCL over the damage (damaged material may be left in place), with a minimum overlap of 12 inches on all edges. Accessory bentonite should be placed between the patch edges and the repaired material at a rate of a quarter pound per lineal foot of edge spread in a continuous six inch fillet.

C. Damaged GCL material on slopes shall be repaired by the same procedures above, however, patch shall overlap the edges of the hole or tear by a minimum of 24 inches in all directions and the edges of the patch should also be adhered to the repaired liner with an adhesive to keep the patch in position during backfill or cover operations.

D. All repairs shall be made at no additional cost to the OWNER.

3.5 FIELD QUALITY CONTROL

A. Field inspection and testing shall be performed in accordance with the CQA MANUAL and as indicated in the Contract Documents. The GEOSYNTHETICS INSTALLER shall designate a full-time quality control (QC) technician who shall be
responsible for supervising and/or conducting the field quality control program. The QC technician may not be replaced without written authorization by the CQA MANAGER.

3.6 SURVEY CONTROL

A. CQA MANAGER will perform survey of final surface area of geosynthetics to determine quantities for payment purposes.

B. GEOSYNTHETICS INSTALLER shall provide CONTRACTOR and CQA MANAGER with record drawings of geomembrane panel locations and extent of the geomembrane. Drawings shall be submitted in both electronic and hardcopy format.

***END OF SECTION***
SECTION 31 23 00
EXCAVATION AND FILL

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, and
      incidentals required to perform all site preparation, excavation, filling, and
      grading, and furnish all required soil materials, as shown in the Contract
      Drawings and/or as specified in this Section.
   2. No classification of excavated materials will be made. Excavation shall
      include all materials regardless of type, character, composition, moisture,
      or condition thereof.

B. Related Sections
   1. Section 31 05 19.13 Geotextiles for Earthwork
   2. Section 31 05 19.16 Geomembranes for Earthwork
   3. Section 31 05 19.23 Geosynthetic Clay Liners
   4. Section 32 91 16 Planting Soil Stabilization

C. State of Wyoming Department of Transportation (WYDOT) Standard
   Specifications for Road and Bridge Construction, 2010 Edition

D. CQA Plan

1.2 REFERENCES

A. Latest Version of American Society for Testing and Materials (ASTM) standards:
   1. ASTM D698 - Test Methods for Laboratory Compaction Characteristics of
      Soil Using Standard Effort (12,400 ft-lb/ft³ (600 kN-m/m³)).
   2. ASTM D2434 - Standard Test Method for Permeability of Granular Soils
      (Constant Head)
   3. ASTM D2922 - Standard Test Methods for Density of Soil and Soil-
      Aggregate in Place by Nuclear Methods (Shallow Depth).
   4. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock
      in Place by Nuclear Methods (Shallow Depth).
   5. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and
      Plasticity Index of Soils.

1.3 TERMINOLOGY

A. The following words or terms are not defined but, when used in this Section,
   have the following meaning:
   1. “Subgrade” is the uppermost surface of native soil material unmoved from
      cuts or of placed fill.
1.4 SOURCE OF SUPPLY

A. The source for all Structural Fill material shall be the cell excavation. For bidding purposes, the CONTRACTOR may assume that sufficient quantities of Structural Fill, meeting the specified requirements, will be available for use from the on-site excavation.

B. Sand drainage layer, gravel material, Class W road base, and Class B bedding material (and bid alternate operations layer material) shall be sourced and imported by the CONTRACTOR from an approved off-site source.

1.5 SUBMITTALS

A. For each soil type specified in Part 2 of this Section, the CONTRACTOR shall submit laboratory data confirming the material meets project requirements a minimum of 14 days prior to starting construction.

CONTRACTOR shall also be prepared to provide CQA MANAGER with 5-gallon pail samples of each of the proposed soils or authorization to access the proposed source for sampling.

Imported material shall not be shipped to the site until the submittal is approved by the CQA MANAGER.

B. The CONTRACTOR shall discuss with the CQA MANAGER the proposed methods and/or proposed equipment to be used for construction, including stripping, excavation, filling, moisture-conditioning, compaction, and backfilling for the various portions of the Work. The review shall be for method only. The CONTRACTOR shall remain responsible for the adequacy and safety of the methods.

1.6 CONSTRUCTION QUALITY ASSURANCE AND QUALITY CONTROL

A. All Work shall be constructed, monitored, and tested in accordance with the CQA Plan or as set forth by the CQA MANAGER.

B. All soil testing (both field and laboratory testing) shall be the responsibility of the CONTRACTOR (Quality Control) and/or the CQA MANAGER (Quality Assurance). The CONTRACTOR shall be responsible for cooperating with the CQA MANAGER during all testing activities. The CONTRACTOR shall provide equipment and labor to assist the CQA MANAGER in sampling, if requested, and they shall also provide access to all areas requiring testing activities.

C. CONTRACTOR shall retain the services of independent testing laboratory to perform testing and determine compliance with the materials specified in this Section and the CQA Plan.

D. CONTRACTOR shall be responsible for maintaining grade control throughout the Work.

E. All excavation, backfill, and grading operations shall be monitored by the CQA MANAGER.
F. Any Work found unsatisfactory or any Work disturbed by subsequent operations before acceptance is granted shall be corrected by the CONTRACTOR as directed by the CQA MANAGER at no additional cost to the OWNER.

1.7 TOLERANCES

A. Excavation limits are defined by the lines and grades shown in the Contract Drawings.

B. The tolerances for construction, unless otherwise approved by CQA MANAGER, shall be as follows:
   1. Slopes:
      a. Line: ± 0.2 feet
      b. Grade: ± 0.1 feet
   2. Floors:
      a. Line: ± 0.2 feet
      b. Grade: ± 0.1 feet

1.8 PROTECTION OF WORK

A. CONTRACTOR shall use all means necessary to protect all prior work and materials.

B. After fill materials have been placed, the CONTRACTOR shall maintain the surface free of ruts, depressions, and/or damage resulting from the hauling and handling of any material, equipment, tools, etc. In the event of damage, the CQA MANAGER will identify any areas requiring repair, and the CONTRACTOR shall make all repairs and replacements necessary to the satisfaction of the CQA MANAGER and at no additional cost to the OWNER.

C. Erosion control must be maintained. Erosion control measures shall be as specified in the Surface Water Pollution Prevention Plan (SWPPP).

D. CONTRACTOR shall protect benchmarks, survey markers, fences, roads, sidewalks, paving, curbs, and other existing structures from damage due to the CONTRACTOR’s activities.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Structural Fill shall consist of on-site soils derived from the excavation and/or other on-site borrow area that consist of relatively homogenous, well-graded natural soils that are free of debris, foreign objects, large rock fragments, roots and organic material. No materials larger than 3-inches shall be allowed. Structural fill materials shall be classified according to the Unified Soil Classification System (USCS) as either SP, SW, SM, or SC material.

B. Sand drainage layer material shall consist of medium to fine grained, uniformly graded, subrounded sand with a permeability equal to or greater than $1 \times 10^{-2}$ cm/sec.
C. Bid alternate operations layer material shall consist of earthen material with a permeability equal to or greater than $1 \times 10^{-3}$ cm/sec.

D. LCRS gravel material shall consist of a washed, uniformly-graded mixture of crushed stone or uncrushed gravel, with 100 percent passing the 1.5-inch sieve, and not more than five percent passing the No. 4 sieve. The material shall be free of debris, foreign objects, large rock fragments, and other deleterious matter. The gravel material shall exhibit a permeability of no less than 1 cm/sec and have a calcium carbonate content of less than 15%.

E. Aggregate road base material shall consist of Class W grading base course material that meets the requirements of Section 803.4.3 of WYDOT Standard Specifications.

F. Pipe bedding material shall be Class B Bedding that meets the requirements of Section 803.11 of the WYDOT Standard Specifications.

G. Any material which is found to be unsuitable for construction by the CQA MANAGER shall be removed from the work area by the CONTRACTOR at no additional cost to the OWNER.

PART 3 – EXECUTION

3.1 SITE PREPARATION

A. The CONTRACTOR shall develop access to the construction area(s) as necessary and in consideration of Article 1.8 of this Section.

B. CONTRACTOR shall contact utility companies and locate, mark out, and protect all existing utilities (including overhead utilities) before commencement of the Work.

C. CONTRACTOR shall contact utility companies and locate, mark out, and protect all existing utilities before commencement of the Work.

D. CONTRACTOR shall coordinate traffic control and barricades with OWNER and maintain OWNER’s access to site throughout the Work.

3.2 CLEARING AND GRUBBING

A. If required, clearing shall be done within the footprint of the limits of the construction area(s), as delineated in the Contract Drawings. Clearing shall extend a maximum of 15 feet and a minimum of 10 feet outside of the construction limits, or as directed by CQA MANAGER.

B. No clearing shall be performed until written permission is given by the OWNER, and until construction staking has been provided for the Proposed Work.

C. CONTRACTOR shall strip all vegetative matter, rubbish, roots in excess of 1-inch diameter, and other deleterious materials from the designated area(s). In no case shall unsuitable deleterious materials, as determined by CQA MANAGER, be incorporated into Structural Fill materials.
D. In areas designated to be stripped of unsuitable or objectionable materials, said materials shall be stripped to the full depth of organic or other unsuitable material as determined by the CQA MANAGER.

E. Stripped and grubbed vegetation shall be removed and disposed in stockpiles or wasted by way of other approved methods in an area designated by OWNER in accordance with permits obtained from the appropriate local, state, and federal regulatory agencies.

3.2 TOPSOIL REMOVAL

A. Topsoil shall be stripped to a minimum depth of 6 inches, or as approved by CQA MANAGER, where required.

B. Topsoil shall be excavated and removed in a manner that will minimize contamination with other soil horizons. Such measures as are necessary shall be taken to ensure that the removal of topsoil does not result in erosion or excessive sedimentation as described in the CONTRACTOR’S SWPPP.

C. Removed topsoil shall be stockpiled at locations designated by OWNER. Stored topsoil shall not be disturbed by construction or on-site activities, and shall be protected from wind and water erosion, unnecessary compaction, and contamination that would lessen the capability of the material to support vegetation when redistributed.

D. Topsoil stockpiles shall be graded to minimize erosion and prevent ponding of precipitation in the stockpile areas. Stockpiled topsoil shall be protected by an effective temporary re-vegetation, as specified in Section 32 91 16, Planting Soil Stabilization.

E. Stockpiled topsoil shall not be moved until required for redistribution on a regraded area.

3.3 EXCAVATION

A. Excavation shall be performed to the lines and grades indicated in the DRAWINGS. No excavation shall begin until the CONTRACTOR has provided construction staking for the proposed work.

B. CONTRACTOR shall minimize the disturbance to surrounding areas during excavation.

C. Work shall be suspended by CONTRACTOR when, in the opinion of the CQA MANAGER, the site is overly wet, muddy, or otherwise unsuitable for proper maintenance, until directed otherwise by CQA MANAGER.

D. Where the required lines, levels and grades are not otherwise defined (such as where the excavation is anchor trenches or to assist with in tie-in with existing liner), CONTRACTOR shall excavate, as necessary, for the items that are to be placed in the excavations and as necessary to provide working space to install and inspect those items.
E. All necessary precautions shall be taken to preserve the material below and beyond the lines of excavation in the soundest possible condition. Where required to complete the Work, all excess excavation or over-excavation shall be refilled with approved Structural Fill materials placed and compacted to the satisfaction of the CQA MANAGER.

F. Safe temporary construction slopes shall be the responsibility of CONTRACTOR. CONTRACTOR shall inspect all temporary and permanent open-cut excavations on a regular basis for signs of instability. Should signs of instability be noted, CONTRACTOR shall immediately undertake remedial measures and shall notify CQA MANAGER immediately. Permanent cut slopes shall be left in smooth, safe, and stable condition at the end of the workday.

G. All materials excavated shall either be placed in stockpiles to be used as Structural Fill material or hauled to the designated waste spoil stockpile area. During excavation, grades shall be maintained to provide drainage of any surface waters that may impact the WORK.

3.4 UNAUTHORIZED EXCAVATION

A. All excavations outside lines and grades shown or indicated and that are not approved by the OWNER, together with removing and disposing of the associated material, shall be at CONTRACTOR’s expense. Unauthorized excavations shall be filled and properly-compacted with Structural Fill material at CONTRACTOR’s expense.

3.5 STOCKPILE CONSTRUCTION

A. Stockpiles shall have side slopes no steeper than 4H:1V and shall not exceed a maximum elevation of El. 6680. The stockpiles shall be graded to drain, sealed by tracking parallel to the slope with a dozer or other means, and dressed daily during periods with fill is taken from the stockpile. The CONTRACTOR shall cover stockpiles with plastic sheeting or other temporary re-vegetation.

B. Surplus excavated soils shall be hauled and deposited in the designated waste stockpile spoil area. The waste stockpile spoil area shall be graded to drain to the northwest to promote positive drainage. No mechanical compaction is necessary.

C. Watering shall be performed during stockpiling to control dust.

3.6 SURFACE WATER CONTROL

A. CONTRACTOR shall construct surface water control features as shown in the Contract Drawings and/or as required to prevent significant erosion and sediment transport of stockpiles, excavation, and fill areas from storm water runoff.

B. The CONTRACTOR shall provide all equipment and facilities and perform all Work to make and keep work areas dry of surface water; construct the temporary sediment control systems; and improve the systems immediately if improvements are subsequently found to be necessary or prudent.
C. The CONTRACTOR shall prevent injury and damage due to dewatering, disposal of water, and sediment control.

D. The CONTRACTOR shall remove the temporary facilities when they are no longer necessary and restore the areas disturbed by dewatering and temporary sediment control.

E. The CONTRACTOR shall be liable for injury and damage resulting from failure to satisfactorily control sediment.

E. The CONTRACTOR is responsible for control of all surface water, as determined by OWNER or CQA MANAGER, for the orderly progress of the Work.

3.7 FINISH GRADING

A. CONTRACTOR shall uniformly grade the areas within limits of grading as indicated in the DRAWINGS, including adjacent transition areas, to a minimum 2% slope.

B. CONTRACTOR shall smooth subgrade surfaces within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.

3.8 SUBGRADE PREPARATION

A. The prepared subgrade shall be a minimum of 6 inches in thickness and be placed or excavated to the lines and grades as shown in the Contract Drawings and compacted to a minimum of 95% of the maximum dry density as measured according to ASTM D698 (Standard). The subgrade shall be moisture conditioned to achieve a uniform moisture content of ± 3 percent of optimum moisture. The dry unit weight and moisture content shall be measured in-place according to ASTM D2922 (Method B) and ASTM D3017 at the frequencies presented in the CQA Plan.

B. The prepared subgrade shall be free of loose materials, clods, rock and other debris including grade stakes and hubs and, where required, seal rolled with a smooth drum roller or by other CQA MANAGER approved method.

C. If excessive rutting or pumping (movements of more than 1 inch) is noted, as determined by CQA MANAGER, the subgrade at that location will be compacted or removed and replaced until deemed acceptable by the CQA MANAGER.

3.9 ANCHOR TRENCH EXCAVATION

A. The anchor trenches shall be excavated to the lines, grades, and widths shown in the Contract Drawings, prior to any geosynthetic material placement. CQA MANAGER shall verify that the anchor trench has been constructed according to the DRAWINGS.

B. The anchor trench shall be backfilled and compacted as approved by the CQA MANAGER. Trench backfill material shall be placed in 9 to 12 inch thick loose lifts and compacted by wheel rolling with light, rubber-tired or other light
compaction equipment, as approved by CQA MANAGER. Anchor trench backfill shall be moisture conditioned as required to achieve a moisture content of ± 3 percent of optimum moisture content as required by method specification as approved by CQA MANAGER.

C. Care shall be taken when backfilling the trenches to prevent any damage to the geosynthetic materials. At no time shall construction equipment come into direct contact with the geosynthetic materials. If damage occurs, it shall be repaired by the CONTRACTOR prior to the completion of backfilling, at no additional cost to the OWNER.

D. CONTRACTOR shall coordinate with GEOSYNTHETICS INSTALLER on the timing for anchor trench excavation, and assist the GEOSYNTHETICS INSTALLER with placing geosynthetic materials into the anchor trench as shown in the Contract Drawings and/or as required. The geosynthetic materials shall be seamed, bonded, or attached along the entire distance of the anchor trench by the GEOSYNTHETICS INSTALLER prior to backfilling the anchor trenches.

3.10 SAND DRAINAGE LAYER PLACEMENT

A. CONTRACTOR shall place leachate collection sand drainage layer in a single lift, as shown in the Contract Drawings. No mechanical compaction is necessary.

B. CONTRACTOR shall coordinate with GEOSYNTHETICS INSTALLER on the timing of sand drainage layer placement relative to geosynthetic liner installation.

C. A dozer with a ground pressure of less than 7 psi, or CQA MANAGER approved equivalent shall be used to spread the sand drainage layer over the geomembrane and shall operate only over previously placed sand drainage layer material. At no time will rubber tired vehicle traffic be allowed on the sand drainage layer.

D. The sand drainage layer shall be pushed up the side slopes in a single lift.

E. At all times, a minimum of 12 inches of sand drainage layer material shall be maintained between equipment and the geomembrane.

F. The CONTRACTOR shall not operate equipment directly over riser pipes or leachate collection pipes.

G. The CONTRACTOR shall take steps to minimize wrinkle size and generation in the geomembrane being covered. Placement hours and methods of protective cover soil operations may be restricted to prevent the development of wrinkles and stress bridging of the underlying geomembrane. CONTRACTOR must be prepared to adjust cover soil placement schedules so operations take place during cool temperature periods (e.g. early morning or night hours). CONTRACTOR shall provide adequate illumination if early morning or night hours are necessary to place cover soils. CONTRACTOR shall notify OWNER three days in advance of proposed schedule change for early morning or night hours placement operations.
H. Wrinkles that must unavoidably be buried should be divided into smaller wrinkles by ground personnel walking them out and approved by the CQA MANAGER. The wrinkles must be trapped in a near-vertical position by a ground-man as they are buried by sand, and in no case shall be greater than three (3) inches.

I. CONTRACTOR shall construct 36-inch thick haul roads, turnouts, staging and dump areas for all rubber-tired transport vehicles and loaders within the landfill cells. CONTRACTOR shall provide ground-man for each piece of placement equipment and not operate equipment without the presence of the ground-man.

J. CONTRACTOR shall expose by hand all locations where spinning tracks or tires may have damaged underlying geosynthetics, as directed by the CQA MANAGER.

3.11 LCRS GRAVEL PLACEMENT

A. CONTRACTOR shall place LCRS gravel around the leachate collection pipes and in sumps as shown in the Contract Drawings. LCRS gravel shall be underlain and covered by geotextile as shown in the Contract Drawings.

B. CONTRACTOR shall verify that HDPE piping and geotextile is installed prior to placement of gravel material.

C. CONTRACTOR shall ensure that HDPE piping is secured and not damaged by LCRS gravel placement.

3.12 SURVEY CONTROL

A. Surveying of the final location and elevation of the tops of the liner subgrade and the drainage layer and leachate collection piping will be performed by CQA MANAGER after placement of fill materials to verify quantities for payment purpose. Thicknesses will be verified by CQA MANAGER on a 50’ by 50’ grid.

***END OF SECTION***
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<tr>
<td><strong>DIVISION 00 – BIDDING AND CONTRACTING REQUIREMENTS</strong></td>
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<tr>
<td>00 01 10 Table of Contents</td>
<td>00 01 15 List of Drawings</td>
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<td>00 41 00 Bid Form</td>
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<td><strong>DIVISION 01 – GENERAL REQUIREMENTS</strong></td>
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<tr>
<td>01 11 00 Summary of Work</td>
<td>01 22 13 Measurement and Payment</td>
</tr>
<tr>
<td>01 40 00 Quality Assurance and Quality Control Requirements</td>
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<td><strong>DIVISION 31 – EARTHWORK</strong></td>
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<tr>
<td>31 05 19.13 Geotextiles for Earthwork</td>
<td>31 05 19.16 Geomembranes for Earthwork</td>
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<tr>
<td>31 05 19.22 Geocomposites</td>
<td>31 05 19.23 Geosynthetic Clay Liners</td>
</tr>
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</table>

***END OF TABLE OF CONTENTS***
SECTION 00 01 15

LIST OF DRAWINGS

PART 1 – GENERAL

1.1 DESCRIPTION

A. This Section lists the Drawings for the Happy Jack Landfill Phase 2, Cells 1 and 2 Construction and Cell 3 Excavation Earthworks Project.

1.2 CONTRACT DRAWINGS

A. The Contract Drawings are as follows:

1. Sheet 1 – Cover Sheet
2. Sheet 2 – Existing Conditions
3. Sheet 3 – Subgrade Plan
4. Sheet 4 – Liner and Leachate Collection System Plan
5. Sheet 5 – Leachate Force Main Plan and Profile (Sheet 1 of 2)
6. Sheet 6 – Leachate Force Main Plan and Profile (Sheet 2 of 2)
7. Sheet 7 – Liner Details
8. Sheet 8 – Leachate Collection System Details (Sheet 1 of 2)
9. Sheet 9 – Leachate Collection System Details (Sheet 2 of 2)
10. Sheet 10 – Leachate Collection System P&ID
11. Sheet 11 – Leachate Collection System Cell Discharge Pipe System Sections and Details
12. Sheet 12 – Fence Details

1.3 PROJECT CONDITIONS

A. CONTRACTOR shall inform OWNER of any discrepancies, errors, or omissions discovered or in the Bidding Documents.

B. Where there are differences, as determined by the OWNER, between details and dimensions shown on the Contract Drawings and details and dimensions of existing features at the Site, CONTRACTOR shall use details and dimensions of existing features at the Site.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

***END OF SECTION***
### BASE BID UNIT PRICE SCHEDULE

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<tr>
<th>Bid Item</th>
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<th>Bid Quantity</th>
<th>Unit Price</th>
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**TOTAL BASE BID:** $591,000

---

### BID ALTERNATE UNIT PRICE SCHEDULE

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SECTION 01 11 00

SUMMARY OF WORK

PART 1 – GENERAL

1.1 SUMMARY

A. The Work specified in this Contract consists of furnishing all management, supervision, labor, materials, tools, equipment, services, testing and incidentals for the completion of the Work as indicated in the Contract Documents.

B. The information presented in the Bidding Documents illustrates the best information available. Existing field conditions shall be field verified prior to performance of the Work.

1.2 PROJECT INFORMATION

A. Project Name: Happy Jack Landfill, Phase 2 Cells 1 And 2 Construction and Cell 3 Excavation, Geosynthetics Procurement.

B. ENGINEER’s Project No.: 123-81971

C. Project Site (the Site): Happy Jack Landfill
   1461 Happy Jack Rd
   Cheyenne, WY 82009

D. OWNER: City of Cheyenne

E. ENGINEER: Golder Associates Inc.

F. OWNER’s REPRESENTATIVE: Solid Waste Professionals of Wyoming, LLC

G. CQA FIRM/MANAGER: Solid Waste Professionals of Wyoming, LLC

H. Contracting Method: The OWNER will contract the Work through the following three independently awarded Contracts:
   1. Earthworks
   2. Geosynthetic Procurement
   3. Geosynthetic Installer

   It shall be the responsibility of each Contractor to coordinate with the OWNER, the CQA MANAGER, and the other Contractors to ensure that the Work is scheduled and completed within the Contract Time(s).

   The GEOSYNTHETICS INSTALLER contract will not be executed until FY2022, which commences on July 1, 2021. It is the requirement of this Procurement Contract that all materials be approved and delivered by that date.

   Bidding: The Bid includes a Base Bid and a Bid Alternate. OWNER reserves the right to award Contract on the basis of Base Bid or in consideration of the Bid Alternate.
1.3 DEFINITIONS

A. Wherever used throughout the Specifications, the terms listed below have the meanings indicated:

1. CONTRACTOR – The individual or entity with whom the OWNER has entered into an Agreement for performance of the Earthwork components of the Work.

2. ENGINEER or CQA MANAGER – The entity who is to act as the OWNER’s representative and assume all duties and responsibilities and have the rights and authority assigned to the ENGINEER in the Contract Documents in connection with completion of the Work in accordance with the Contract Documents.

3. OWNER – The City of Cheyenne, Wyoming; owner of the project.

4. GEOSYNTHETICS MANUFACTURER – The individual or entity with whom the OWNER has entered into an Agreement for the procurement of the geosynthetic materials, independent of the earthwork and geosynthetic installation Contracts.

5. GEOSYNTHETICS INSTALLER - The individual or entity with whom the OWNER has entered into an Agreement for the installation of the geomembrane and GCL liners, independent of the earthwork and geosynthetic procurement Contracts.

1.4 DESCRIPTION OF WORK

A. The Work to be performed under this Geosynthetics Procurement Contract includes, but it not limited to the following:

1. Provide 60-mil HDPE geomembrane (double-sided textured);
2. Provide geosynthetic clay liner (GCL);
3. Provide 12 ounce per square yard nonwoven geotextile;
4. Provide 12 ounce per square yard nonwoven geotextile; and
5. Bid alternate provide 200 mil geocomposite.

Please see Section 01 22 13, Measurement and Payment for detailed descriptions of the Work and all unit price pay items.

B. The GEOSYNTHETICS MANUFACTURER is responsible for delivering materials F.O.B. (free on board) to the Project Site. The CONTRACTOR will unload and store materials.

1.5 OWNER RESPONSIBILITIES

A. OWNER will arrange for and deliver necessary electronic versions of Contract Drawings to GEOSYNTHETICS MANUFACTURER for information and coordination of the Work and for installation.

B. OWNER will furnish the data required of OWNER under the Contract Documents.

1.6 WORK BY OTHERS

A. The CONTRACTOR shall be responsible for unloading the materials at the site and for storing and protecting the materials prior to installation, as described in the Specifications.
The GEOSYNTHETICS INSTALLER will deploy and install the geomembrane and the GCL (and the bid alternate geocomposite). The CONTRACTOR shall be responsible for the installation of the geotextile as shown in the Contract Drawings.

B. All other materials required to complete the Work, other than those specifically identified in Article 1.6A of this Section, shall be furnished by the CONTRACTOR.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

A. The GEOSYNTHETICS MANUFACTURER shall comply with all local, state, and federal laws and regulations. OWNER will not be liable for any fines, penalties, etc.

***END OF SECTION***
PART 1 – GENERAL

1.1 DESCRIPTION

A. This Section describes the administrative and procedural requirements for how Lump Sum and Unit Price pay items established in the Agreement will be measured and paid for when making progress and final payments.

B. Lump Sum and Unit Price pay items listed in this Section refer to and are the same pay items listed in the Bid Form and constitute all pay items for completing the Work in this Contract. Compensation for all services, items, materials, and equipment required to complete the Work shall be paid at the Lump Sums and Unit Prices included in the Contract.

C. All measurements and payments will be based on completed Work performed in strict accordance with the Contract Documents and in accordance with Contract Lump Sums and Unit Prices. Incidental Work and items not listed in the Contract Bid Form will not be paid separately but will be included in the payment for the listed item or items to which such incidental Work applies.

D. Lump Sums and Unit Prices shall include all direct and indirect costs, including GEOSYNTHETICS MANUFACTURER’s overhead and profit for each separately identified item.

1.2 ENGINEER’S ESTIMATE OF QUANTITIES

A. ENGINEER’s estimated quantities for Unit Price pay items, as listed in the Bid Form, are approximate only and are included solely for the purpose of comparison of Bids. OWNER does not expressly or by implication agree that the actual quantities of material encountered or required will correspond therewith and reserves the right to increase or decrease any quantity or to eliminate any quantity, as OWNER may deem necessary.

1.3 PAYMENT PROCEDURES

A. CONTRACTOR shall submit Applications for Payment in accordance with Contract requirements.

1.4 UNIT PRICE BID ITEMS

A. Payment items for the Work of this Contract on which the Contract Unit Price payments will be made are listed in the Bid Form. The Unit Price and payment made for each item listed shall constitute full compensation for furnishing all materials and performing any associated GEOSYNTHETICS MANUFACTURER quality control.

B. Contract Unit Price multiplied by agreed quantity is full compensation.
1.5 BASE BID ITEMS

A. Item 1 – Furnish 60 mil HDPE Geomembrane (double-sided textured)
   1. Measurement and payment shall be by square footage of 60 mil HDPE Geomembrane (double-sided textured) delivered to the Site.
   2. Payment shall include all costs to manufacture and deliver 60 mil HDPE Geomembrane (double-sided textured) to the Site, including all welding rod, testing and Quality Control documentation, and handling requirements as discussed in the SPECIFICATIONS and CQA Manual.
   3. The GEOSYNTHETICS MANUFACTURER is responsible for delivering materials F.O.B. to the project site. The CONTRACTOR will unload and store materials.

B. Item 2 – Furnish Geosynthetic Clay Liner (GCL)
   1. Measurement and payment shall be by square footage of GCL delivered to the Site.
   2. Payment shall include all costs to manufacture and deliver GCL to the Site, and all straps for offloading, including accessory bentonite for sealing seams and all testing and Quality Control documentation and handling requirements as discussed in the SPECIFICATIONS and CQA Manual.
   3. The GEOSYNTHETICS MANUFACTURER is responsible for delivering materials F.O.B. to the project site. The CONTRACTOR will unload and store materials.

C. Item 3A – Furnish 12 oz/sy Nonwoven Geotextile Fabric
   1. Measurement and payment shall be by square footage of 12 oz/sy geotextile delivered to the Site.
   2. Payment shall include all costs to manufacture and deliver 12 oz/sy geotextile to the Site, including all testing and Quality Control documentation and handling requirements as discussed in the SPECIFICATIONS and CQA Manual.
   3. The GEOSYNTHETICS MANUFACTURER is responsible for delivering materials F.O.B. to the project site. The CONTRACTOR will unload and store materials.

D. Item 3B – Furnish 16 oz/sy Nonwoven Geotextile Fabric
   1. Measurement and payment shall be by square footage of 16 oz/sy geotextile delivered to the Site.
   2. Payment shall include all costs to manufacture and deliver 16 oz/sy geotextile to the Site, including all testing and Quality Control documentation and handling requirements as discussed in the SPECIFICATIONS and CQA Manual.
   3. The GEOSYNTHETICS MANUFACTURER is responsible for delivering materials F.O.B. to the project site. The CONTRACTOR will unload and store materials.

1.6 BID ALTERNATE ITEM DESCRIPTIONS

A. Item 4 – Furnish Geocomposite
   1. Measurement and payment shall be by square footage of geocomposite delivered to the Site.
2. Payment shall include all costs to manufacture and deliver geocomposite to the Site and all testing and Quality Control documentation and handling requirements as discussed in the SPECIFICATIONS and CQA Manual.

3. The GEOSYNTHETICS MANUFACTURER is responsible for delivering materials F.O.B. to the project site. The CONTRACTOR will unload and store materials.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

***END OF SECTION***
PART 1 – GENERAL

1.1 DESCRIPTION

A. Section includes: administrative and procedural requirements for quality assurance (QA) and quality control (QC).

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve CONTRACTOR of responsibility for compliance with the Contract Document requirements.

1.2 DEFINITIONS

A. Construction Quality Control (CQC): A planned system of inspections that is used to directly monitor and control the quality of a construction project. CQC is normally performed by the material/equipment installer or for natural soil materials by the CONTRACTOR, and is necessary to achieve quality in the constructed or installed system. CQC refers to measures taken by the Installer or CONTRACTOR to determine compliance with the requirements for materials and workmanship as stated in the Contract Documents.

B. Construction Quality Assurance (CQA): A planned system of activities that provides the OWNER assurance that the facility was constructed as specified in the design. CQA includes inspection, verifications, audits, and evaluations of materials and workmanship necessary to determine and document the quality of the constructed facility.

1.3 RESPONSIBILITIES

A. The CQA MANAGER will be responsible for all Quality Assurance testing as outlined in this Specification and the Construction Quality Assurance (CQA) Manual, unless otherwise noted.

B. The CONTRACTOR shall maintain an effective Construction Quality Control program. The system shall encompass all action involving selection of construction material sources and on-site and off-site production of construction materials, WORK placement procedures, workmanship, and as required, monitoring and testing.

1.4 TESTING AND FREQUENCY

A. Quality Control/Quality Assurance tests and frequency are discussed throughout the Specifications and in the CQA Manual. The frequencies indicated are minimums only, and do not include re-testing of failed materials. Those Quality Control/Quality Assurance tests and testing frequencies to be conducted in the field by the CQA MANAGER are presented in the CQA Manual.
1.5 QUALITY OF MATERIALS AND LABOR

A. All materials used on this Contract shall be new and the best market quality, unless specified or shown otherwise. All labor on this contract shall be competent and skilled for the Work. All Work executed under this contract shall be done in the best, most thorough, substantial and workmanlike manner. All material and labor shall be subject to the approval of the CQA MANAGER as to quality and compliance with the design and the Contract Documents and shall be removed if it does not meet with these requirements. The OWNER or CQA MANAGER may refuse to issue any certificate or payment until all defective materials or Work have been removed, and other material of proper quality substituted therefore. The cost associated with wasted or improperly installed materials that are placed by reasons of the failure of the CONTRACTOR to conform to the provisions of the Contract will not be paid for. This includes, but is not restricted to, additional quantities of materials, delays, Work, loading, hauling or disposal of the rejected materials.

B. All off-site earth materials proposed for use in the project shall be reviewed for the content of asbestos and other potential hazards or contamination.

1.6 CONTRACTOR RESPONSIBILITIES

A. The CONTRACTOR is responsible for the quality of the Work of the Contract.

B. The CONTRACTOR shall make good all Work for which any test result indicates the Work does not conform to the requirements of the Contract.

C. The CONTRACTOR shall certify that all equipment used in the Work is in accordance with the provisions of the Contract. Certification does not relieve responsibility for providing satisfactory materials, equipment, and workmanship.

D. Any inspection and/or testing shall not relieve the CONTRACTOR from any responsibility for the quality of the Work.

E. The CONTRACTOR shall be aware of all testing activities as presented in the CQA Manual and shall account for those activities in the construction schedule.

F. The CONTRACTOR shall be responsible for cooperating with the CQA MANAGER during all testing activities. CONTRACTOR shall provide equipment and labor to assist the CQA MANAGER in sampling, if requested, and shall also provide access to all areas requiring testing activities.

G. No Work shall be covered before the CQA MANAGER has approved the Work. If any material is covered without the approval of the CQA MANAGER, the CONTRACTOR will be required to re-excavate to expose the covered materials. The cost of exposing those materials and then backfilling and re-compacting, or otherwise doing rework, will be at the CONTRACTOR'S expense, regardless of the condition of the materials under question.

H. Upon start of installation of granular drainage/operations layer, CONTRACTOR shall be responsible for protection and maintenance of the geomembrane.
PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

***END OF SECTION***
SECTION 31 05 19.13

GEOTEXTILES

PART 1 - GENERAL

1.1 SUMMARY

A. Scope:
   1. This section describes the general requirements for the manufacture, supply, installation, and quality control (QC) of geotextile fabric associated with the Work.
   2. The geotextile will be procured directly by the OWNER from the GEOSYNTHETICS MANUFACTURER. The CONTRACTOR shall be responsible for unloading, storing, and installing the geotextile fabric as specified.

B. RELATED SECTIONS
   1. Section 31 05 19.16 Geomembranes for Earthwork
   2. Section 31 05 19.23 Geosynthetic Clay Liners
   3. Section 31 23 00 Excavation and Fill
   4. Section 33 46 16 Subdrainage Piping

1.2 REFERENCES

A. Latest Version of American Society for Testing and Materials (ASTM) standards:
   2. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity
   4. ASTM D4632 - Standard Test Method for Breaking Load and Elongation of Geotextiles (Grab Method)
   7. ASTM D5199 - Standard Test Method for Measuring Geotextiles
   8. ASTM D5261 - Standard Test Method for Measuring Mass Per Unit Area of Geotextiles

1.3 SUBMITTALS

A. The GEOSYNTHETICS MANUFACTURER shall provide the following information after Contract award, but no later than 14 days prior to material arrival on site and prior to commencement of the Work:
   1. Written certification that the geotextile to be used meets the requirements of the Project.
   2. Certificates of origin and the manufacturer of the resin
3. A copy of the manufacturer’s geotextile QC test results of properties outlined in Part 2 of this Section. The CQA MANAGER reserves the right to refuse use of any geotextile supplied without the proper QC documentation.

4. A detailed list of performance criteria for the geotextile material being produced for the Project. Refer to Part 2 of this Section for geotextile properties and test methods.

1.4 QUALITY ASSURANCE

A. The GEOSYNTHETICS MANUFACTURER shall ensure that their internal product quality control program meets the Contract requirements.

B. GEOSYNTHETICS MANUFACTURER shall provide required QC information at least 14 days prior to geotextile being shipped to the Site for review and approval by the OWNER’s REPRESENTATIVE. GEOSYNTHETICS MANUFACTURER shall also assure that the geotextile is delivered to the site at least five calendar days prior to installation.

C. Geotextile rolls that do not meet the performance criteria requirements shall be rejected. GEOSYNTHETICS MANUFACTURER shall be required to replace the rejected material with new material that complies with the performance criteria requirements, at no additional cost to OWNER.

1.5 DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping
   1. Geotextile fabric shall be supplied in rolls wrapped in relatively impermeable and opaque protective covers, with straps for unloading.
   2. Geotextile rolls shall be marked or tagged with the following information.
      a. Manufacturer’s name
      b. Product information
      c. Roll number
      d. Batch of lot number
      e. Roll dimensions
   3. The GEOSYNTHETICS MANUFACTURER shall ensure that geotextile rolls are properly loaded and secured to prevent damage during transit.
   4. The GEOSYNTHETICS MANUFACTURER shall protect geotextile from excessive heat, puncture, cutting, or other damaging or deleterious conditions during shipping and delivery.
   5. The GEOSYNTHETICS MANUFACTURER shall ensure personnel responsible for loading and transport are familiar with handling and transport constraints imposed by Manufacturer and as required by this SPECIFICATION.
   6. The CONTRACTOR shall ensure personnel responsible for unloading and storing materials on site are familiar with handling and transport constraints imposed by Manufacturer and as required by this SPECIFICATION.

B. Acceptance at the Site
   1. The CQA MANAGER shall perform inventory and surface inspection for defects and damage of all geotextile rolls upon delivery.
   2. The CONTRACTOR shall unroll and allow for the CQA MANAGER inspection of any geotextile roll that may be damaged below surface layers.
3. The GEOSYNTHETICS MANUFACTURER shall repair damage resulting from handling and transport of geotextile to site at no cost to OWNER. If irreparable, in the opinion of CQA MANAGER, damaged materials shall be replaced at no cost to OWNER.

C. Storage and Protection

1. OWNER shall provide on-site storage area for geotextile rolls from time of delivery until installation.

2. The offloading and storage of the materials is the responsibility of the CONTRACTOR from the time the materials are off-loaded and inspected by the CQA MANAGER until the time the completed installation is accepted. CONTRACTOR is also responsible for offloading from shipper to storage and for preparing the storage location, off the ground, and for the protection of the material from the elements (e.g. ultraviolet light, moisture, temperature, etc.).

3. After CONTRACTOR has removed material from storage area, protect geotextile from puncture, dirt, groundwater, moisture, mud, mechanical abrasion, excessive heat, ultraviolet light exposure, and other sources of damage.

4. Geotextile rolls shall be stored in relatively opaque and water tight wrappings.

5. CONTRACTOR shall preserve integrity and readability of the geotextile roll labels, and store such that CQA MANAGER shall have access to the package slips or roll labels for each roll to verify roll acceptance. The CQA MANAGER will perform inventory and surface inspection for any defects or damage to rolls upon delivery. The GEOSYNTHETICS MANUFACTURER shall replace any defective or damaged rolls at no cost to the OWNER.

PART 2 - PRODUCTS

2.1 GEOTEXTILE FABRIC

A. The geotextile fabric shall be non-woven, needle punched, and shall be comprised of 95 percent polypropylene or polyester fibers by weight. Rolls shall be free of holes, contamination, and foreign matter. The geotextile for the project shall meet or exceed the minimum (unless noted otherwise) roll values shown in Table 31 05 19.13-1 below:

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PART 3 – EXECUTION

3.1 INSPECTION

A. CONTRACTOR shall verify the elevations and observe the conditions under which the Work is to be performed. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the CQA MANAGER.

B. CONTRACTOR shall review installation procedures under other Sections and coordinate the installation of items that must be installed prior to and/or with the geotextile fabric.

3.2 INSTALLATION

A. CONTRACTOR shall place geotextile fabric according to Manufacturer’s recommendations.

B. Geotextile seams shall be secured in accordance with manufacturer's recommendations or as approved by CQA MANAGER. Geotextile seams shall be overlapped a minimum of 12 inches.

C. The CONTRACTOR shall examine the entire geotextile surface after installation to ensure, to the satisfaction of the CQA MANAGER that no potentially harmful foreign objects are present. Such foreign objects shall be removed and damaged geotextile shall be repaired or replaced by the CONTRACTOR at no cost to OWNER.

D. CONTRACTOR shall use care not to damage underlying materials during installation.

E. CONTRACTOR shall prevent the geotextile from accumulating excessive dust.

F. The CONTRACTOR shall be responsible for field handling, storing, deploying, seaming or connecting, temporary restraining (against wind), anchoring, and other aspects of geotextile installation.

G. The CONTRACTOR shall accept and retain full responsibility for all materials upon delivery to the Site through installation and shall be held responsible for any defects.

H. No equipment shall operate directly on geotextile fabric.

3.3 REPAIRS

A. Any holes or tears in the geotextile shall be repaired using a geotextile patch consisting of the same geotextile secured with a 12-inch overlap in all directions.

B. Damaged areas too large for patching shall be removed and replaced as directed by the CQA ENGINEER.
3.4 PLACEMENT OF SOIL OR GRANULAR MATERIALS

A. All soil or granular materials located on top of a geotextile shall be placed in such a manner as to ensure:
   1. The geotextile and/or underlying geosynthetic are not damaged.
   2. Minimal slippage of the geotextile on underlying layers occurs.
   3. Minimal movement and wrinkling or folding of the underlying geosynthetic layer(s) occurs.
   4. No excess tensile stresses shall occur in the geotextile, such as by earth moving equipment making sudden starts, stops, or turns. The allowable ground pressure for equipment shall be prescribed by these Specifications and/or the CQA MANAGER for the material type and layer thickness.

***END OF SECTION***
SECTION 31 05 19.16
GEOMEMBRANES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope
1. This section describes the general requirements for the manufacture, supply, installation, and quality control (QC) of High-Density Polyethylene (HDPE) geomembrane associated with the Work.
2. The geomembrane will be procured directly by the OWNER from the GEOSYNTHETICS MANUFACTURER. The CONTRACTOR shall be responsible for unloading, storing, and installing the geomembrane as specified.

B. Related Sections
1. Section 31 05 19.13  Geotextiles for Earthwork
2. Section 31 05 19.23  Geosynthetic Clay Liners
3. Section 31 23 00  Excavation and Fill

1.2 REFERENCES

A. Latest Version of American Society for Testing and Materials (ASTM) standards:
2. ASTM D1004 Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
3. ASTM D1204 Standard Test Method for Linear Dimensional Changes of Non-rigid Thermoplastic Sheet or Film at Elevated Temperature.
8. ASTM D5321 Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic Friction by the Direct Shear Method
9. ASTM D5397 Notched Constant Tensile Load Test for Geomembrane.
13. ASTM D6392 Standard Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods
B. GRI GM13 Standard Specification for Supply of HDPE Geomembrane

C. GRI GM 19 Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembranes

D. CQA MANUAL

1.3 PRE-QUALIFICATION

A. The GEOSYNTHETICS INSTALLER shall pre-qualify for geosynthetic installation by providing the following qualification documentation:
   1. The GEOSYNTHETICS INSTALLER shall have a minimum of 10,000,000 square feet (sf) of HDPE geosynthetic cumulative installation experience.
   2. The GEOSYNTHETICS INSTALLER shall provide at least three references from prior installation projects in excess of 500,000 sf including the following information:
      a. Client’s name, address, phone number and contact or representatives name.
      b. Project site and description.
      c. Geosynthetic type(s) and quantity installed.

B. The installation crew shall have the following experience.
   1. The superintendent shall have supervised the installation of a minimum of 2,000,000 ft² of polyethylene geomembrane and 500,000 ft² of geotextile.
   2. The master seamer shall have experience seaming a minimum of 1,000,000 ft² of polyethylene geomembrane using the same type of seaming apparatus to be used at this site.
   3. All other seaming personnel shall have seamed at least 100,000 ft² of polyethylene geomembrane using the same type of seaming apparatus to be used at this site. Personnel who have seamed less than 100,000 ft² of polyethylene geomembrane shall be allowed to seam only under the direct supervision of the master seamer or Superintendent.

1.4 SUBMITTALS

A. The GEOSYNTHETICS MANUFACTURER shall furnish the following in writing to the CQA MANAGER a minimum of fourteen (14) calendar days prior to geomembrane shipment to the site:
   1. Quality Control Program:
      a. Certificates for each shift’s production of geomembrane, and statements of production dates.
      b. Certification stating all geomembrane rolls are furnished by one manufacturer, and all rolls are manufactured from one resin type obtained from one resin supplier.
      c. Copies of quality control certificates, including:
         i. Roll numbers and identification;
         ii. Sampling procedures; and
         iii. Results of quality control tests, including descriptions of the test methods used.
      d. The results of the manufacturing quality control tests shall meet or exceed the property values listed in Table 31 05 19.16-1.
e. Geomembrane delivery, storage, handling and installation instructions.

2. Resin:
   a. Statement of production dates and origin of resin used to manufacture the geomembrane for the project.
   b. Certification stating all resin is from the same manufacturer and that reclaimed polymer added to the resin during the manufacturing of the geomembrane does not exceed 2 percent by weight.
   c. Copies of the quality control certificates issued by the manufacturer and resin supplier indicating that the resin used to manufacture the geomembrane meets these specifications.

3. Extrudate Beads and/or Welding Rod:
   a. Statement of production dates.
   b. Certification stating all extrudate is from one manufacturer, is the same resin type, and was obtained from the same resin supplier as the resin used to manufacture the geomembrane rolls.
   c. Copies of quality control certificates issued by the Manufacturer.

B. Prior to mobilization of the GEOSYNTHETICS INSTALLER to the Site, the GEOSYNTHETICS INSTALLER shall submit the following:
   1. Shop drawings indicating panel layout and field seams. Each panel shall be assigned an identification number.
   2. Installation schedule.
   3. Copy of GEOSYNTHETICS INSTALLER letter of approval or license by the GEOSYNTHETICS MANUFACTURER.
   4. Proposed installation capabilities, including:
      a. Information on equipment proposed for this project;
      b. Average daily production anticipated for this project; and
      c. Quality control procedures.
   5. Resume of the superintendent and Quality Control Inspector for GEOSYNTHETICS INSTALLER to be assigned to this project, including dates and duration of employment. Substitution of these key personnel, without prior notification and approval by CQA MANAGER will be sufficient grounds for removal of GEOSYNTHETICS INSTALLER from the Project.
   6. Resumes of all GEOSYNTHETICS INSTALLER personnel who will perform seaming operations on this project, including dates and duration of employment.

C. Immediately upon Notice of Award, CONTRACTOR shall make available to the CQA MANAGER samples of the geomembrane for interface shear testing and conformance testing.

D. During the installation, the GEOSYNTHETICS INSTALLER shall be responsible for the timely submission to the CQA MANAGER of subgrade acceptance certificates, signed by the GEOSYNTHETICS INSTALLER and CONTRACTOR, for each area to be covered by geosynthetic clay liner and geomembrane.

E. The GEOSYNTHETICS MANUFACTURER or GEOSYNTHETICS INSTALLER shall furnish the OWNER upon completion of the project:
   1. A 20-year written warranty provided by the GEOSYNTHETICS MANUFACTURER against defects in material. Warranty conditions
concerning limits of liability will be evaluated and must be acceptable to the OWNER.

2. A 1-year warranty provided by the GEOSYNTHETICS INSTALLER against defects in workmanship. Warranty conditions concerning limits of liability will be evaluated and must be acceptable to the OWNER.

1.5 QUALITY ASSURANCE

A. All Work shall be constructed, monitored, and tested in accordance with the CQA Manual. The CONTRACTOR, GEOSYNTHETICS INSTALLER and GEOSYNTHETICS MANUFACTURER shall participate and comply with all items in the CQA Manual.

B. Geomembrane sampling shall be conducted by GEOSYNTHETICS INSTALLER in accordance with the specifications for the following:
   1. Conformance Testing
   2. Destructive Seam Testing

C. GEOSYNTHETICS INSTALLER shall attend a pre-installation conference. Attendance of parties directly affecting the WORK of this Section will be mandatory.

1.6 DELIVERY, STORAGE AND HANDLING

A. CONTRACTOR and GEOSYNTHETICS INSTALLER shall conform to the Manufacturer's requirements to prevent damage to geomembrane.

B. Transportation of the HDPE geomembrane by the GEOSYNTHETICS MANUFACTURER shall be through an independent trucking firm and shall be shipped via a closed or flatbed trailer.

C. Offloading and storage of the HDPE geomembrane shall be the responsibility of the CONTRACTOR. Handling and care of the HDPE geomembrane after acceptance by the CQA MANAGER, prior to and following installation, will be the responsibility of the GEOSYNTHETICS INSTALLER, until Final Acceptance of the liner system by the CQA MANAGER.

D. Delivery:
   1. GEOSYNTHETICS MANUFACTURER shall deliver materials to the site only after the CQA MANAGER approves the required submittals.
   2. All rolls of geomembrane delivered to the site shall be identified by the GEOSYNTHETICS MANUFACTURER at the factory with the following:
      a. Manufacturer’s name
      b. Product identification
      c. Lot number
      d. Roll number
      e. Roll dimensions
   3. CQA MANAGER and CONTRACTOR must be present when HDPE geomembrane is delivered to the site. GEOSYNTHETICS MANUFACTURER shall notify CQA MANAGER a minimum of 2 business days prior to delivery.
   4. CONTRACTOR is responsible for separating damaged rolls from undamaged rolls and storing at locations designated by the CQA MANAGER.
until proper disposition of material is determined by the OWNER and the CQA MANAGER.
5. The OWNER will be the final authority regarding damage.
6. CONTRACTOR shall separate rolls without proper documentation and store until the CQA MANAGER approval is received. Rolls or pallets without proper identification by GEOSYNTHETICS MANUFACTURER shall be subject to rejection.

E. On-site Storage:
1. CONTRACTOR shall store in space allocated by the OWNER.
2. Protect from puncture, dirt, grease, water, moisture, mud, mechanical abrasions, excessive heat or other damage.
3. Store on level prepared surface (not on wooden pallets).
4. Stack per Manufacturer's recommendation but no more than three rolls high.
5. CONTRACTOR shall preserve integrity and readability of the HDPE geomembrane roll labels, and store such that CQA MANAGER shall have access to the package slips or roll labels for each roll to verify roll acceptance.

F. On-site Handling:
1. GEOSYNTHETICS INSTALLER shall use appropriate handling equipment to load, move or deploy geomembrane rolls. Appropriate handling equipment includes cloth chokers and spreader bar for loading, spreader and roll bars for deployment. Dragging panels on ground surface will not be permitted.
2. GEOSYNTHETICS INSTALLER shall not fold geomembrane material; folded material shall be rejected.

G. Damaged Geomembrane:
1. Geomembrane damage will be documented by the CQA MANAGER.
2. Geomembrane found damaged upon arrival at the site shall be replaced by the GEOSYNTHETICS MANUFACTURER at no additional cost to the OWNER.

PART 2 - PRODUCTS
2.1 MATERIALS

A. The geomembrane shall be comprised of high-density polyethylene (HDPE) material as indicated in the Contract Drawings, manufactured of new, first-quality products designed and manufactured specifically for the purpose of liquid containment in hydraulic structures.

B. The geomembrane shall be produced free of holes, blisters, undispersed raw materials, or any sign of contamination by foreign matter. Any such defect shall be repaired in accordance with the repair procedures in this Section.

C. The geomembrane shall be manufactured with a minimum seamless width of 15 feet. There shall be no factory seams.

D. The primary geomembrane liner shall be HDPE 60 mil textured double-sided as indicated in the Contract Drawings.
E. The geomembrane shall be supplied in rolls; folds will not be permitted. Identify each roll with labels indicating lot number, roll number, thickness, length, width, manufacturer, and plant location.

E. Specifications for HDPE geomembrane properties are presented in Table 31 05 19.16-1. Supplied material shall conform to these properties based upon the manufacturer’s QC testing and CQA conformance testing.

G. Resin:
1. Shall be HDPE, new, first quality, compounded and manufactured specifically for producing HDPE geomembrane.
2. Do not intermix resin types.
3. Resin shall meet the following additional requirements of Table 31 05 19.16-2.

H. Extrudate Rod or Bead:
1. Shall be made from same resin as the geomembrane.
2. Additives shall be thoroughly dispersed.
3. Shall be free of contamination by moisture or foreign matter.
4. Shall meet the requirements of Table 31 05 19.16-3.
### TABLE 31 05 19.16-1

**HDPE GEOMEMBRANE PROPERTIES**

<table>
<thead>
<tr>
<th>Property</th>
<th>Qualifier</th>
<th>Units</th>
<th>Specification</th>
<th>Minimum Manufacturer QC Test Frequency</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Thickness</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Minimum Average</td>
<td>min. avg.</td>
<td>mils</td>
<td>60</td>
<td>Per roll</td>
<td>ASTM D5994</td>
</tr>
<tr>
<td>2. Lowest individual for 8 of 10 values</td>
<td>min.</td>
<td>mils</td>
<td>54</td>
<td>Per roll</td>
<td>ASTM D5994</td>
</tr>
<tr>
<td><strong>Asperity Height</strong></td>
<td>min. avg.</td>
<td>mil</td>
<td>16</td>
<td>Every 2nd roll</td>
<td>GRI GM 12</td>
</tr>
<tr>
<td><strong>Density</strong></td>
<td>min. avg.</td>
<td>g/cc</td>
<td>0.940</td>
<td>200,000 lb</td>
<td>D792 or D1505</td>
</tr>
<tr>
<td><strong>Tensile Properties</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Yield Stress</td>
<td>min. avg.</td>
<td>lb/in</td>
<td>126</td>
<td>20,000 lb</td>
<td>ASTM D638</td>
</tr>
<tr>
<td>2. Break Stress</td>
<td>min. avg.</td>
<td>lb/in</td>
<td>90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Yield Elongation</td>
<td>min. avg.</td>
<td>%</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Break Elongation</td>
<td>min. avg.</td>
<td>%</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tear Resistance</strong></td>
<td>min. avg.</td>
<td>Lb</td>
<td>42</td>
<td>45,000 lb</td>
<td>ASTM D1004</td>
</tr>
<tr>
<td><strong>Puncture Resistance</strong></td>
<td>min. avg.</td>
<td>Lb</td>
<td>90</td>
<td>45,000 lb</td>
<td>ASTM D4833</td>
</tr>
<tr>
<td><strong>Stress Crack Resistance</strong></td>
<td>Note 3</td>
<td>hours</td>
<td>500</td>
<td>per GM 10</td>
<td>ASTM D5397</td>
</tr>
<tr>
<td><strong>Carbon Black Content</strong></td>
<td>range</td>
<td>%</td>
<td>2.0 – 3.0</td>
<td>20,000 lb</td>
<td>ASTM D1603</td>
</tr>
<tr>
<td><strong>Carbon Black Dispersion</strong></td>
<td>rating</td>
<td>Cat.</td>
<td>Note 5</td>
<td>45,000 lb</td>
<td>ASTM D5596</td>
</tr>
<tr>
<td><strong>Oxidative Induction Time (OIT)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard OIT, or High Pressure OIT</td>
<td>min. avg.</td>
<td>Min.</td>
<td>100</td>
<td>200,000 lb</td>
<td>ASTM D 3895</td>
</tr>
<tr>
<td><strong>Oven Aging at 85˚ C</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Standard OIT (min avg) - % retained after 90 days; or (b) High Pressure OIT (min avg) - % retained after 90 days</td>
<td>min. avg.</td>
<td>%</td>
<td>55</td>
<td>per each formulation</td>
<td>ASTM D 5721</td>
</tr>
<tr>
<td><strong>UV Resistance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Pressure OIT (min avg) - % retained after 1600 hrs</td>
<td>min. avg.</td>
<td>%</td>
<td>50</td>
<td>per each formulation</td>
<td>GRI GM 11</td>
</tr>
</tbody>
</table>

**Notes**

1. Lowest individual reading must be > 5 mil. Perform 10 readings for each side and calculate average for each side of every 2nd roll.
2. Type IV die ASTM D638 test specimen shall be used. Machine Direction (MD) and Cross Machine Direction (XMD) average values shall be on the basis of 5 test specimens each direction. Yield elongation is calculated using a gage length of 1.3 inches. Break elongation is calculated using a gage length of 2.0 inches.
3. The SP-NCTL test is not appropriate for testing geomembranes with textured or irregular rough surfaces. Test should be conducted on smooth edges of textured rolls or on smooth sheets made from the same formulation used for the textured sheet materials. The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer’s mean value via MQC testing.
4. Other means such as D 4218 (muffle furnace) are acceptable if an appropriate correlation to D 1603 (tube furnace) can be established.
5. Carbon Black Dispersion for 10 different views: All 10 in Categories 1 or 2
6. The manufacturer has the option to select either one of the OIT methods listed to evaluate the
antioxidant content in the geomembrane. Samples shall be evaluated at 30 and 60 days to compare with the 90-day response.

7. The condition of the test should be 20 hr. UV cycle at 75°C followed by 4-hr. condensation at 60°C.

8. The UV Resistance is based on the percent-retained value regardless of the original HP-OIT value.

### TABLE 31 05 19.16-2
HDPE RESIN PROPERTIES

<table>
<thead>
<tr>
<th>Test (1,3)</th>
<th>Test Designation</th>
<th>Minimum Manufacturer QC Test Frequency</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>ASTM D 1505 or ASTM D 792 Method B</td>
<td>(2)</td>
<td>≥ 0.932</td>
</tr>
<tr>
<td>Melt Index</td>
<td>ASTM D 1238 Condition E</td>
<td>(2)</td>
<td>&lt; 1.0 g per 10 minutes</td>
</tr>
<tr>
<td>OIT</td>
<td>ASTM D 3895 (1 atm at 200°C)</td>
<td>(2)</td>
<td>≥ 100 minutes</td>
</tr>
</tbody>
</table>

Notes:
1. Resin without carbon black
2. One test per resin batch
3. The manufacturer may choose either Standard OIT or High Pressure OIT to evaluate antioxidant content

### TABLE 31 05 19.16-3
EXTRUDATE OR BEAD PROPERTIES

<table>
<thead>
<tr>
<th>Test</th>
<th>Test Designation</th>
<th>Minimum Manufacturer QC Test Frequency</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>ASTM D 1505 or ASTM D 792 Method B</td>
<td>(1)</td>
<td>≥ 0.940</td>
</tr>
<tr>
<td>Carbon Black Content</td>
<td>ASTM D 1603</td>
<td>(1)</td>
<td>2-3%</td>
</tr>
<tr>
<td>Melt Index</td>
<td>ASTM D 1238 Condition E</td>
<td>(1)</td>
<td>&lt; 1.0 g per 10 minutes</td>
</tr>
</tbody>
</table>

Notes:
1. One test per resin lot or batch of extrudate or bead used for extrusion welding.
2.2 EQUIPMENT

A. Welding equipment and accessories of GEOSYNTHETICS INSTALLER shall meet the following requirements:
   1. Equipped with gauges showing temperatures both in apparatus and at nozzle (extrusion welder) or at wedge (fusion welder).
   2. Maintain adequate number of welding apparatus to avoid delaying work.
   3. Use power source capable of providing constant voltage under combined-line load.
   4. Provide secondary containment to catch spilled fuel under electric generator, if located on geomembrane.

B. GEOSYNTHETICS INSTALLER shall provide two (2) calibrated tensiometers (one for backup) capable of quantitatively measuring geomembrane strength:
   1. Equipped with gauge accurate to \( \pm 2 \) lbs per inch of geomembrane width and capable of pulling at 2 inches per minute and 20 inches per minute.
   2. Provide one inch die for cutting sample specimens.
   3. Provide certificate of tensiometer calibration within the past 12-months.
   4. CQA MANAGER shall be allowed to utilize tensiometers to conduct testing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. GEOSYNTHETICS INSTALLER shall verify in writing that the surface on which the geomembrane will be installed is acceptable. In so doing the Installation GEOSYNTHETICS INSTALLER shall assume full liability for the accepted surface.

B. The GEOSYNTHETICS INSTALLER shall be responsible for maintenance of the geomembrane covered geosynthetic clay liner once installation of geomembrane begins.

3.2 PREPARATION

A. GEOSYNTHETICS INSTALLER is to maintain the surface suitability and integrity until the lining installation is completed, leak location survey is completed and accepted.

B. GEOSYNTHETICS INSTALLER shall repair rough areas and any damage to the subgrade (below the geosynthetic clay liner) caused by installation of the lining and fill any ruts in subgrade caused by equipment prior to geosynthetic clay liner and geomembrane deployment.

3.3 DEPLOYMENT

A. Geomembrane shall not be deployed by GEOSYNTHETICS INSTALLER:
   1. During precipitation;
   2. In the presence of excessive moisture;
   3. In areas of ponded water;
   4. In the presence of excessive winds; and
   5. In excessive heat or cold.
B. Each panel shall be marked with an “identification code” (number or letter) by the GEOSYNTHETICS INSTALLER consistent with the layout plan. The identification code shall be simple and logical. The number of panels deployed in one day shall be limited by the number of panels which can be seamed on the same day. All deployed panels shall be seamed to adjacent panels by the end of each day.

C. The following is the acceptable method of deployment by GEOSYNTHETICS INSTALLER:
   1. Use equipment which will not damage geomembrane by handling, trafficking, leakage of hydrocarbons or other means.
   2. Do not allow personnel working on geomembrane to wear damaging shoes, or engage in activities that could damage geomembrane.
   3. Smoking on the liner is prohibited.
   4. Round sharp corners of clamps and other metal tools used in the WORK area.
   5. Do not allow clamps and other metal tools to be tossed or thrown.
   6. Unroll panels with a method that protects geomembrane from scratches and crimps and protects soil surface and underlying geosynthetic clay liner from damage.
   7. Use a method to minimize wrinkles, especially differential wrinkles between adjacent panels.
   8. Place adequate hold-downs to prevent uplift by wind.
   9. Use hold-downs that will not damage geomembrane such as sandbags.
   10. Use continuous hold-downs along leading edges to minimize risk of wind flow under panels.
   11. Panels shall be deployed perpendicular to slope elevation contours and the generation of seams shall be minimized.
   12. Protect geomembrane in heavy traffic areas by geotextile, extra geomembrane or other suitable materials.
   13. Do not allow vehicular traffic including ATVs on geomembrane surface.
   14. Panels deployed on grades steeper than 12% shall extend a minimum of 5 feet and less than 10 feet beyond the crest or toe of that slope.
   15. Single-sided textured geomembrane shall be placed with textured side down.

D. GEOSYNTHETICS INSTALLER shall visually inspect sheet surface during unrolling of geomembrane and mark faulty or suspect areas for repair or test. Replace faulty (requires more than one patch per 200 square feet) geomembrane stock at no additional cost to the OWNER.

E. GEOSYNTHETICS INSTALLER shall deploy geomembrane in ambient temperatures less than 104 °F (40° C) and greater than 32° F (0° C), measured 6 inches above geomembrane surface. In prevailing warm or cold weather conditions deployment may be acceptable if the provisions for sampling in such conditions is satisfied (see Section 3.5 below). The geomembrane shall not be deployed during precipitation, in the presence of excessive moisture, in areas of ponded water, or in the presence of excessive winds.

F. GEOSYNTHETICS INSTALLER shall deploy HDPE in a relaxed manner and free of tension and stress. In areas where grade transitions occur, the geomembrane shall not be allowed to bridge or trampoline.
G. GEOSYNTHETICS INSTALLER shall be responsible for anchoring installed geomembrane until drainage/operations layer material is installed by the CONTRACTOR.

3.4 FIELD SEAMING BY GEOSYNTHETICS INSTALLER

A. Orient seams perpendicular to slope elevation contours, i.e., orient down (not across) slope and use seam numbering system compatible with panel number system.

B. Minimize the number of field seams in corners, odd-shaped geometric locations and outside corners.

C. Overlap panels by a minimum of 3 inches for extrusion welding and 4 inches for fusion welding. Use procedures to temporarily bond adjacent panels together that do not damage the geomembrane and that are not detrimental to seam weld material for extrusion welding.

D. Do not use solvent or adhesive unless product is approved in writing by the CQA MANAGER.

E. No horizontal seams shall be allowed on grades steeper than 12% or within 5 feet to 10 feet of the crest or toe of slopes. A horizontal seam is defined as more than half of the panel width.

F. Clean surface of grease, moisture, dust, dirt, debris or other foreign material.

G. Prior to any extrusion welding, the geomembrane seam or repair shall be prepared as follows:
   1. Clean surface of oxidation by disc grinder or equivalent not more than one hour before seaming; use number 80 grit sandpaper for the disc grinder. Bevel edges of geomembrane before bonding and provide continuous tacking in repair areas.
   2. Repair area where excessive grinding substantially reduces sheet thickness by more than 4 mils beyond extents of weld.
   3. Clean grinding dust around weld area after grinding.
   4. The following procedure shall be followed for wrinkles and fishmouths.
      a. Cut along the ridge of the wrinkle or fishmouth.
      b. Overlap a minimum of 3 inches and seam.
      c. Any portion where the overlap is less than 3 inches shall be patched with an oval or round patch of geomembrane that extends a minimum of 6 inches beyond the cut in all directions.
   5. If required, a firm, dry substrate (piece of geomembrane or other material) may be placed directly under the seam overlap to achieve proper support.
   6. Keep water from intercepting the weld during and immediately after welding the seam.
   7. For existing welds, or welds that are over 10 minutes old, grind the existing weld two inches back from point of termination and restart welding on ground weld.

H. At least one spare operable seaming apparatus shall be maintained for every three seaming teams. Place protective fabric or piece of geomembrane beneath hot
welding apparatus when resting on geomembrane lining and use an electric generator capable of providing constant voltage under combined line load. The electric generator shall be located outside of liner unless otherwise approved by CQA MANAGER. Provide protective lining and secondary containment large enough to catch spilled fuel under electric generators approved to operate on the liner. The welding apparatus shall be equipped with gauges giving temperatures in apparatus and at nozzle.

I. For extrusion welding, purge welding apparatus of heat-degraded extrudate before welding if extruder is stopped for longer than five minutes. All purged extrudate shall be disposed of off the geomembrane. Each extruder shoe shall be inspected daily for wear to assure that its offset is the same as the geomembrane thickness. Repair or replace worn shoes, damaged or mis-aligned armature brushes, nozzle contamination, or other worn or damaged parts. Avoid stop-start welding. Remove extrudate rod from welder when not using welder for long periods (over two hours). No welding may commence on the liner until the field trial seam sample, made by that equipment and seamer, passes destructive testing.

J. Test and set “hot air system” using scrap material at least each day prior to commencing seaming and adjust hot air velocity to preclude wind effects. Adjust contact pressure rollers to prevent surface ripples in sheet. No equipment shall be used for welding the geomembrane until a field trial seam sample made by that equipment has passed destructive testing.

K. In performing hot wedge welding, the welding apparatus shall be automated vehicular mounted devices equipped with gauges giving applicable temperatures and pressures. The edge of cross seams shall be ground to a smooth incline (top and bottom) prior to welding. A smooth insulating plate or fabric shall be placed beneath the hot welding apparatus after usage. Protect against moisture buildup between sheets. If welding across cross seams, conduct field test seams at least every two hours, otherwise once prior to start of work and once at mid-day. No equipment is allowed to commence welding on geomembrane until the field trial seam sample made by that piece of equipment has passed destructive testing.

L. Field trial seams shall be conducted, per seaming apparatus and per seamer, on pieces of geomembrane liner to verify adequate seaming conditions at the following frequency:
   1. At beginning of each seaming period.
   2. At least once every five hours.
   3. At the discretion of the CQA MANAGER

M. Make the trial seams at area of seaming and in contact with subgrade or geosynthetic clay liner (same condition as the liner to be seamed). The seam sample shall be at least 42 inches long and 12 inches wide with the seam centered lengthwise. A one-foot length of each trial seam sample shall be submitted to the CQA MANAGER for archives. Cut three 1-inch wide specimens and test two for peel adhesion, and one for bonded seam strength (shear). Each double wedge fusion seam specimens shall be tested for peel on both sides of the weld. CQA MANAGER shall have access to use GEOSYNTHETICS INSTALLER tensiometer. A specimen passes when:
   1. The break is film tearing bond (FTB) conforming to the values shown in Table 31 05 19.16-4.
2. The break is ductile.
3. The strength of breaks for the trial seam testing shall conform to the values listed in Table 31 05 19.16-4.

**TABLE 31 05 19.16-4**
**HDPE GEOMEMBRANE SEAM PROPERTIES**

<table>
<thead>
<tr>
<th>Property</th>
<th>Qualifier</th>
<th>Units</th>
<th>Specification</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shear Seam Strength</td>
<td>Min</td>
<td>lb/in.</td>
<td>120</td>
<td>ASTM D6392</td>
</tr>
<tr>
<td>Shear Elongation at break</td>
<td>&gt;</td>
<td>%</td>
<td>50</td>
<td>ASTM D6392</td>
</tr>
<tr>
<td>Peel Adhesion</td>
<td>min</td>
<td>lb/in.</td>
<td>91</td>
<td>ASTM D6392</td>
</tr>
<tr>
<td>Fusion</td>
<td>min</td>
<td>lb/in.</td>
<td>78</td>
<td>ASTM D6392</td>
</tr>
<tr>
<td>Extrusion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peel Separation</td>
<td>Maximum</td>
<td>%</td>
<td>25</td>
<td>ASTM D6392</td>
</tr>
<tr>
<td>Fusion/Extrusion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
1. Manufacturers use g/10 min as units.
2. All values, except when specified as minimum or maximum, represent average lot property values.
4. Film Tear Bond (FTB) is defined as failure of one of the sheets by tearing, instead of separating from the other sheet at weld interface area (sheet fails before weld).
5. Units, English or metric, shall be consistent with manufacturers specifications.
6. FTMS 101C Method 2065.

N. A trial seam sample passes when all specimens have passing results in peel and shear tests. If a specimen fails (one of the specimens fails in either peel or shear mode), the trial seam procedure shall be repeated in its entirety. If the repeated trial seam fails, the seaming apparatus or operator may not weld until the deficiencies or conditions are corrected and two consecutive passing field trial seams are achieved.

O. The following procedures shall be followed during cold weather conditions.
1. Geomembrane surface temperatures shall be determined by the CQA MANAGER at intervals of at least once per 100 feet of seam length to determine if preheating is required. For extrusion welding, preheating is required if the surface temperature of the geomembrane is below 32° F (0° C).
2. For fusion welding, preheating may be waived by the CQA MANAGER if the GEOSYNTHETICS INSTALLER demonstrates to the CQA MANAGER’s satisfaction that welds of equivalent quality may be obtained without preheating at the expected temperature of installation.
3. If preheating is required, the CQA MANAGER will observe all areas of geomembrane that have been preheated by a hot air device prior to seaming, to ensure that they have not been overheated.
4. Care shall be taken to confirm that the surface temperatures are not lowered below the minimum surface temperatures specified for welding due to winds or other adverse conditions. It may be necessary to provide wind protection for the seam area.
5. All preheating devices shall receive approval by the CQA MANAGER prior to use.

6. Additional destructive tests will be taken at an interval between 250 and 500 feet of seam length, at the discretion of the CQA MANAGER.

7. Sheet grinding may be performed before preheating, if applicable.

8. Trial seaming shall be conducted under the same ambient temperature and preheating conditions as the production seams. Under cold weather conditions, new trial seams shall be conducted if the ambient temperature drops by more than 20°F from the initial trial seam test conditions. Such new trial seams shall be conducted upon completion of seams in progress during the temperature drop.

P. The following procedures shall be followed during warm weather conditions.

1. At ambient temperatures above 104°F (40°C), no seaming of the geomembrane shall be permitted unless the Installation GEOSYNTHETICS INSTALLER can demonstrate to the satisfaction of the CQA MANAGER that the geomembrane seam quality is not compromised. Trial seaming shall be conducted under the same ambient temperature conditions as the production seams. At the option of the CQA MANAGER, additional destructive testing or trial seaming may be required for any suspected areas.

3.5 FIELD QUALITY CONTROL BY GEOSYNTHETICS INSTALLER

A. The GEOSYNTHETICS INSTALLER shall designate a full-time quality control (QC) technician who shall be responsible for supervising and/or conducting the field quality control program. The QC technician may not be replaced without written authorization by the CQA MANAGER.

B. All documentation will be completed on a daily basis by the GEOSYNTHETICS INSTALLER in a neat orderly manner, checked for computations and errors prior to turnover, along with a daily QC summary report.

C. Non-Destructive Seam Testing by GEOSYNTHETICS INSTALLER

1. The GEOSYNTHETICS INSTALLER shall non-destructively test field welds for continuity over their full length using vacuum test units or air pressure testing. The non-destructive testing shall be performed concurrently with seaming WORK progress, not at the completion of all seaming. Any defects located in the seam shall be repaired in accordance with Section 3.6. The following non-destructive testing procedures shall be used to test the field seams for continuity.
   a. Vacuum box testing for extrusion welds.
   b. Air pressure testing for double fusion seams.

2. Vacuum Box Testing
   a. The vacuum box testing equipment shall comprise the following.
      i. Rigid housing; transparent viewing window; a soft rubber gasket attached to bottom of housing; porthole or valve assembly; and a vacuum gauge.
      ii. A vacuum pump capable of applying 5 psi gage pressure of vacuum to the box.
      iii. A bucket of soapy solution and applicator.
   b. The procedure for vacuum testing is as follows:
i. Clean window, gasket surfaces, and check for leaks.
ii. Energize vacuum pump and reduce tank pressure to approximately 5 psi.
iii. Wet a strip of geomembrane approximately 12 inches by 30 inches (length of box) with soapy solution.
iv. Place box over wetted area and compress.
v. Close bleed valve and open vacuum valve.
vi. Ensure that a leak tight seal is created.
vii. Examine length of weld through viewing window for presence of soap bubbles for a period of not less than 10 seconds,
viii. If no bubbles appear after 10 seconds, close vacuum valve and open bleed valve, move box over next adjoining area with minimum three inches overlap and repeat process.
ix. Areas where soap bubbles appear will be marked by the CQA MANAGER with a defect code. The Installer shall then repair the area in accordance with Section 3.6 and retest the repaired area.

3. Air Pressure Testing (Double Fusion Seams Only)
a. The air pressure testing equipment shall comprise the following.
   i. An air pump, equipped with pressure gauge with an accuracy of 1 psi, capable of generating and sustaining a pressure between 27 to 30 psi and mounted on a cushion to protect geomembrane.
   ii. Rubber hose with fittings and connections.
   iii. Sharp hollow needle or other pressure feed device approved by the CQA MANAGER.
b. To perform the test:
   i. Seal both ends of the seam to be tested.
   ii. Insert a needle or other approved pressure feed device into tunnel created by double hot wedge seaming and insert a protective cushion between air pump and geomembrane.
   iii. Energize air pump to 27 to 30 psi, close valve, and sustain pressure for a minimum of five minutes.
   iv. If loss of pressure exceeds 2 psi or does not stabilize, locate faulty area and repair in accordance with Section 3.6.
   v. Release pressure at opposite end of seam from gauge to verify that the seam is not blocked.
   vi. Remove approved pressure feed device and seal penetration holes by extrusion welding.

C. Destructive Seam Testing
1. For destructive seam testing, the CQA MANAGER shall be provided with a minimum of one sample per 1000 feet of seam length by each welding apparatus. The location will be selected by the CQA MANAGER and the GEOSYNTHETICS INSTALLER will not be informed of the sample location in advance. The GEOSYNTHETICS INSTALLER shall visually observe, mark and repair suspect welds before release of a section to the CQA MANAGER for destructive sample marking. Cut destructive samples as seaming and nondestructive testing progresses, prior to completion of liner installation. The CQA MANAGER will mark destructive samples with consecutive numbering, location, apparatus I.D., technician I.D., CQA MANAGER I.D., and apparatus settings and date. Record, in written form,
weld and test date, time, location, seam number, ambient temperatures, machine settings, technician I.D., apparatus I.D., and pass or fail description. The GEOSYNTHETICS INSTALLER shall immediately repair holes in geomembrane resulting from obtaining destructive samples and vacuum test patches. The size of destructive samples shall be 12 inches wide by 48 inches long with seam centered lengthwise.

2. Two 1-inch wide specimens shall be taken from each side of the sample and tested by the Installation GEOSYNTHETICS INSTALLER for peel and shear in the field prior to CQA destructive testing. If any of these specimens fail, the GEOSYNTHETICS INSTALLER shall track the failure immediately. The remaining sample shall be cut into three 14-inch long pieces and distributed as follows:
   a. To the CQA MANAGER for destructive testing.
   b. To the CQA MANAGER for archive.
   c. To the GEOSYNTHETICS INSTALLER for his/her use.

3. The GEOSYNTHETICS INSTALLER shall cut ten 1-inch wide specimens from one piece. Five specimens shall be tested for peel and five for shear strengths in accordance with the CQA Plan, with test results meeting the requirements of Table 31 05 19.16-4. CQA MANAGER AND/OR CQA MONITORS shall have access to use either of the GEOSYNTHETICS INSTALLER tensiometers. In the event of failure, the procedures for failed seam tracking are:
   a. Retrace welding path a minimum of 10 feet in both directions from the failed test location and remove (at these locations) a one inch wide specimen for testing. Repeat tracking procedures until the GEOSYNTHETICS INSTALLER is confident of seam quality.
   b. Obtain destructive samples from each side of the welding path and distribute, as described above, to the CQA MANAGER for destructive testing.
   c. Repeat process if additional tests fail.
   d. Reconstruct seam between passing test locations to satisfaction of the CQA MANAGER.
   e. Reconstruction may be one of the following:
      i. Cut out old seam, reposition panel and re-seam.
      ii. Add cap strip.
   f. Cut additional destructive samples from reconstruction at discretion of CQA MANAGER.
   g. If additional destructive sample results are not acceptable, repeat process until reconstructed seam is judged satisfactory by the CQA MANAGER.

D. For final seaming inspection, check the seams and surface of geomembrane for defects, holes, blisters, undispersed raw materials, or signs of contamination by foreign matter. Brush, blow, or wash geomembrane surface if dirt inhibits inspection. The CQA MANAGER shall decide if cleaning of geomembrane surface and welds is needed to facilitate inspection. Distinctively mark repair areas and indicate required type of repair.

3.6 REPAIR PROCEDURES FOR GEOSYNTHETICS INSTALLER

A. The geomembrane will be inspected before and after seaming for evidence of defects, holes, blisters, undispersed raw materials, and any sign of contamination by
foreign matter. The surface of the geomembrane shall be clean at the time of inspection. The geomembrane surface shall be swept or washed by the GEOSYNTHETICS INSTALLER if surface contamination inhibits inspection. The GEOSYNTHETICS INSTALLER shall ensure that an inspection of the geomembrane precedes any seaming of that section.

B. Remove damaged geomembrane and replace with acceptable geomembrane materials if damage cannot be satisfactorily repaired.

C. Repair, removal and replacement shall be at the GEOSYNTHETICS INSTALLER expense if the damage results from the GEOSYNTHETICS INSTALLER activities.

D. Fishmouths shall be slit, laid flat, and seamed with a minimum overlap of 3 inches. Any portion where the overlap is less than 3 inches shall be patched with an oval or round patch of geomembrane that extends a minimum of 6 inches beyond the cut in all directions.

E. Repair any portion of the geomembrane exhibiting a flaw, or failing a destructive or non-destructive test. The GEOSYNTHETICS INSTALLER shall be responsible for repair of damaged or defective areas. Agreement upon the appropriate repair method shall be decided between the CQA MANAGER and the GEOSYNTHETICS INSTALLER. Procedures available include:
   1. Patching: Used to repair holes (over 1/4-inch diameter), tears (over 1/4 inch long), undispersed raw materials, and contamination by foreign matter.
   2. Grinding and welding: Used to repair pinholes, blemishes and over-grinding.
   4. Removing the seam and replacing with a strip of new material.

F. In addition, the following procedures shall be observed.
   1. Geomembrane surfaces to be repaired shall be abraded (extrusion welds only) no more than 1/2 hour prior to the repair.
   2. All geomembrane surfaces shall be clean and dry at the time of repair.
   3. The repair procedures, materials, and techniques shall be approved in advance of the specific repair by the CQA MANAGER.
   4. Extend patches or caps at least 6 inches beyond the edge of the defect, i.e., patch or cap shall be a minimum of 12 inches in diameter, and round all corners of material to be patched.
   5. Bevel the edge of the patch and do not cut patch with repair sheet in contact with geomembrane. Temporary bond the patch to the geomembrane with an approved method, extrusion weld the patch and then vacuum test the repair.
   6. All panel intersections (T-seams) shall be repaired with a patch.

G. Repair Verification:
   1. Number and log each patch repair (performed by the CQA MANAGER).
   2. Non-destructively test each repair using methods specified in this Section.
   3. Provide daily documentation of non-destructive and destructive testing to the CQA MANAGER. The documentation shall identify seams that initially failed the test and include the evidence that these seams were repaired and retested successfully.
3.7 ACCEPTANCE

A. The GEOSYNTHETICS INSTALLER shall retain ownership and responsibility for the geomembrane until acceptance by the OWNER.

B. Acceptance Criteria: The following shall be completed:
   1. Verification of adequacy of field seams, repairs and testing by the CQA MANAGER including leak survey.
   2. All submittals.
   3. As-built drawings, approved and final drawings submitted.
   4. Construction area cleaned.
   5. Final field inspection
   6. Warranty signed over to the OWNER.

C. Field Inspections: Inspect the completed Work with the CQA MANAGER; defects, wrinkles, suspicious looking welds shall be noted and marked; document, correct and arrange further field inspections until no corrective action is necessary.

3.8 CONFORMANCE TESTING

A. Material will be made available to the CQA MANAGER by the GEOSYNTHETICS MANUFACTURER upon notice to proceed for conformance sampling and testing at a minimum frequency of one per 100,000 square feet of material continuously produced and supplied to the project, with a minimum of one sample per production lot. Materials may be sampled at the plant at the option of the OWNER.

B. As a minimum, the following tests will be performed by a geosynthetics CQA laboratory and shall meet the requirements outlined in Table 31 05 19.16-1.
   1. Thickness (ASTM D5994)
   2. Specific Gravity (ASTM D1505)
   3. Carbon Black Content (ASTM D1603)
   4. Carbon Black Dispersion (ASTM D5596)
   5. Tensile Properties (ASTM D638)
   6. Puncture Resistance (ASTM D4833)
   7. Asperity Height (GRI GM 12)

C. If a test result is in non-conformance with the SPECIFICATIONS, all material from that production lot represented by the failed test shall be rejected. Rejected material may be minimized by bounding the nonconformance material with additional passing tests conducted by the geosynthetics CQA laboratory. Additional tests shall be conducted by the GEOSYNTHETICS MANUFACTURER at no additional cost to the OWNER.

D. Rejected material shall be replaced at no additional cost to OWNER.

3.9 ANCHOR TRENCH

A. The CONTRACTOR shall excavate the anchor trenches to the lines, grades, and width shown in the DRAWINGS, prior to any geosynthetic material placement. CQA MANAGER shall verify that the anchor trench has been constructed according to the DRAWINGS.
B. The anchor trench shall be backfilled and compacted as approved by the CQA MANAGER. Trench backfill material shall be placed in 9 to 12-inch thick loose lifts and compacted by wheel rolling with light, rubber-tired or other light compaction equipment, as approved by CQA MANAGER.

C. Care shall be taken when backfilling the trenches to prevent any damage to the geosynthetic materials. At no time shall construction equipment come into direct contact with the geosynthetic materials. If damage occurs, it shall be repaired by the GEOSYNTHETICS INSTALLER prior to the completion of backfilling, at no cost to OWNER.

D. CONTRACTOR shall extend geosynthetic materials into the anchor trench as shown in the DRAWINGS. The geosynthetic materials shall be seamed, bonded, or attached along the entire distance of the anchor trench, using approved methods described in this Section.

3.10 PLACEMENT OF SOIL OR GRANULAR MATERIALS

A. All soil materials located on top of a geomembrane shall be placed by the CONTRACTOR in such a manner as to ensure:
   1. The geomembrane and any underlying geosynthetic material is not damaged.
   2. Minimal slippage of the geomembrane on underlying layers occurs.
   3. Minimal movement and wrinkling or folding of the underlying geosynthetic layer(s) occurs.
   4. No excess tensile stresses shall occur in the geomembrane, such as by earth moving equipment making sudden starts, stops, or turns. The allowable ground pressure for equipment shall be prescribed by CQA MANAGER for the material type and layer thickness.

3.11 SURVEY CONTROL

A. CQA MANAGER will perform survey of final surface area of geosynthetics to determine quantities for payment purposes.

B. GEOSYNTHETICS INSTALLER shall provide CONTRACTOR and CQA MANAGER with record drawings of geomembrane panel locations and extent of the geomembrane. Drawings shall be submitted in both electronic and hardcopy format.

***END OF SECTION***
SECTION 31 05 19.22
GEOCOMPOSITES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. This Section includes requirements for the manufacture, supply, and installation of geocomposite for the project and the construction CQA monitoring and testing. All procedures, operations, and methods shall be in strict compliance with the Specifications, CQA Plan, and the Drawings.

1.2 REFERENCES

A. ASTM D1238 – Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer


D. ASTM D4716-00 – Standard Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head

E. ASTM D5199 - Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes

1.3 SUBMITTALS

A. Contractor shall provide the following information after contract award but at a minimum fourteen (14) days prior to shipping of geocomposite for review and approval by CQA MANAGER:
   1. Information from Manufacturer including company name, address, telephone number, the names of the company president and QC manager, and narrative of the company history.
   2. A list of standard material properties and test methods employed to arrive at the values for each. As a minimum, the list shall include properties given in Part 2.1 of this Section.
   3. The QC Manual followed during the manufacturing process including those for the polymer material and for detecting foreign objects in the finished goods, and a description of the QC laboratory facilities, including the name and telephone number of the QC manager.

B. Contractor shall submit the following geocomposite Manufacturer’s documentation on the raw materials used to manufacture the geocomposite:
1. QC certificates issued by the raw material supplier including the production dates of the raw material used to manufacture the geocomposite for the project.
2. Results of tests conducted by the geocomposite Manufacturer to verify the quality of the resin used to manufacture the geonet assigned to the project and the origin of the resin and QC certificates issued by the resin supplier.
3. Certification that no reclaimed polymer was used in the manufacturing of the geonet to be used for the project.

C. A copy of the Geocomposite Manufacturer’s QC Program.

D. QC certificates for test results at the sampling frequency indicated by the Manufacturer’s QC Plan shall be submitted. The CQA MANAGER reserves the right to refuse use of any geocomposite supplied without the proper QC documentation.

1. Manufacturing QC certificates for each shift’s production shall be signed by responsible parties employed by the Manufacturer (such as the Production Manager).
2. The QC certificates shall include:
   a. Roll numbers and identification
   b. Sampling procedures
   c. Results of the QC tests verifying each of the properties listed in Part 2.1 of this Section
   d. Transmissivity tests do not need to be completed as routine QC tests. However, Manufacturer shall include a written statement that the product has been tested and meets or exceeds the transmissivity requirements. Tests results shall be included
   e. A detailed list of performance criteria for the geocomposite material being produced for this project. (Note: Performance criteria are sometimes referred to as “minimum property values.” Refer to Part 2.1 of this Section for geocomposite properties and test methods.)

1.4 QUALITY ASSURANCE

A. All work shall be constructed, monitored, and tested in accordance with the Manufacturer’s CQA plan. The Contractor and Manufacturer shall participate and comply with all items in these specifications and requirements of the CQA plan.

B. Contractor shall ensure that geocomposite Manufacturer has an internal product QC program that meets Contract requirements.

C. Contractor shall be aware of all activities outlined in the CQA plan, and Contractor shall account for these activities in the construction schedule.

D. The Contractor will provide required QC information at least fourteen (14) days prior to geosynthetics being shipped to the project for review and approval by the Construction Manager and/or Engineer. Contractor shall also assure that the geocomposite is delivered to the site at least five (5) calendar days prior to installation. Conformance testing must be completed, reviewed, and approved by the Construction Manager and/or Engineer prior to shipping of geocomposite to the site.
E. Geocomposite that does not meet the requirements of this specification and the Manufacturer’s CQA plan shall be rejected. Contractor shall be required to replace the rejected material with new material that complies with the specifications.

F. In order to prevent weather damaged geocomposite from being placed, the following QA procedures shall be followed:
   1. Contractor shall perform its work and utilize sufficient ballast as necessary to prevent wind uplift of the geocomposite.
   2. If weather damage should occur, Construction Manager shall determine if the geocomposite shall be repaired or replaced. Weather damage to the geocomposite will include tears and dirty fabric, as determined by the Construction Manager or CQA Monitor.
   3. Repair or replacement of the weather-damaged geocomposite shall be completed by Contractor.

G. Conformance Testing
   1. During manufacturing of the geocomposite, the CQA Monitor will facilitate the collection of samples to the QA Testing Laboratory for testing to ensure conformance with the specifications.
   2. Samples will be taken across the entire width of the roll and shall not include the first 3 ft. Unless otherwise stated, samples will be 3 ft long by the width of the roll. The CQA Monitor will mark the machine direction on the samples with an arrow.
   3. Conformance testing must be completed, reviewed, and approved by Construction Manager or Engineer prior to shipping of geocomposite to the site. Conformance samples shall be collected at the frequencies defined in the CQA Plan. Tests will be performed on the geocomposite to verify conformance to the design specifications with minimum values specified in Part 2.1 of this Section.
   4. If a test result is in nonconformance with the specifications, all material from that production lot presented by the failed test shall be rejected. Rejected material may be minimized by bounding the nonconformance material with additional passing tests conducted by the geosynthetic CQA laboratory.
   5. Rejected material shall be replaced.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping
   1. Geocomposite shall be supplied in rolls wrapped in relatively impermeable and opaque protective covers, with straps for unloading.
   2. Geocomposite rolls shall be marked or tagged with the following information.
      a. Manufacturer’s name
      b. Product information
      c. Roll number
      d. Batch or lot number
      e. Roll dimensions
   3. Contractor shall ensure that geocomposite rolls are properly loaded and secured to prevent damage during transit.
4. Contractor shall protect geocomposite from excessive heat, cold, puncture, cutting, or other damaging or deleterious conditions.
5. Contractor shall ensure personnel responsible for loading, transport, and unloading of geocomposite are familiar with handling and transport constraints imposed by Manufacturer.

B. Acceptance at Site
1. CQA Monitor shall perform inventory and surface inspection for defects and damage of all geocomposite rolls upon delivery.
2. Contractor shall unroll and inspect any geocomposite roll that may be damaged below surface layers.
3. Contractor shall repair damage resulting from handling and transport of geocomposite. If irreparable, in the opinion of CQA Monitor, damaged materials shall be replaced.

C. Storage and Protection
1. Manager shall provide on-site storage area for geocomposite rolls from time of delivery until installation.
2. The storage of the materials is the responsibility of Contractor from the time the materials are off-loaded until the time the completed installation is accepted. Contractor is responsible for preparing the storage location, off the ground, and for the protection of the material from the elements (e.g., ultraviolet light, moisture, temperature, etc.).
3. After Contractor has removed material from storage area, protect geocomposite from puncture, dirt, groundwater, moisture, mud, mechanical abrasion, excessive heat, ultraviolet light exposure, and other sources of damage.
4. Geocomposite rolls shall be stored in relatively opaque and watertight wrappings.
5. Contractor shall preserve integrity and readability of the geocomposite roll labels, and store such that Construction Manager shall have access to the package slips or roll labels for each roll to verify roll acceptance.

1.6 WARRANTY
A. Special Warranty: Manufacturer’s standard form in which Manufacturer agrees to repair or replace components of equipment that fails in materials or workmanship within specified warranty period.
1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS
2.1 MATERIALS
A. Geocomposite shall be high-density polyethylene (HDPE) and manufactured by extruding two crossing strands to form a bi-planer drainage net structure with a non-woven geotextile bonded to both sides.
B. The geonet shall be comprised of a minimum 95 percent pure polyethylene. The remaining portion shall be made up of materials necessary for the performance of the geonet (such as carbon black, anti-oxidants, etc.).
C. The geocomposite used for the work shall meet or exceed (unless noted otherwise) the minimum properties listed in the Table 31 05 19.25-1 for an 8oz/sy geocomposite:
Table 31 05 19.22-1
GEOCOMPOSITE PROPERTIES

| Tested Property | Test Method | Frequency | Minimum Average Roll Valuea
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Geocomposite</td>
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<td>6 oz/yd²</td>
</tr>
<tr>
<td>Product Code</td>
<td>ASTM D 4716</td>
<td>1/540,000 ft²</td>
<td>0.48 (1 x 10⁻⁴)</td>
</tr>
<tr>
<td>Transmissivityb</td>
<td>ASTM D 7005</td>
<td>1/50,000 ft²</td>
<td>1.0 (178)</td>
</tr>
<tr>
<td>Ply Adhesion, lb/ft (g/cm)</td>
<td>ASTM D 4716</td>
<td>1/50,000 ft²</td>
<td>14.5 (4.4)</td>
</tr>
<tr>
<td>Roll Widthc, ft (m)</td>
<td>ASTM D 4716</td>
<td>230 (70.1)</td>
<td>200 (60.9)</td>
</tr>
<tr>
<td>Roll Lengthd, ft (m)</td>
<td>ASTM D 4716</td>
<td>3,335 (310)</td>
<td>2,900 (269)</td>
</tr>
<tr>
<td>Roll Area, ft² (m²)</td>
<td>ASTM D 4716</td>
<td>2.0</td>
<td>2.0</td>
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<td>Geonet corec</td>
<td>ASTM D 5199</td>
<td>1/50,000 ft²</td>
<td>200 (5)</td>
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<tr>
<td>Thickness, mil (mm)</td>
<td>ASTM D 1505</td>
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<td>0.94</td>
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<td>Density, g/cm³</td>
<td>ASTM D 5035</td>
<td>1/50,000 ft²</td>
<td>45 (7.9)</td>
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<td>Tensile Strength (MD), lb/lin (N/mm)</td>
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<td>1/50,000 ft²</td>
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<td>Carbon Black Content, %</td>
<td>ASTM D 5261</td>
<td>6 (200)</td>
<td>8 (270)</td>
</tr>
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<td>Mass per Unit Area, oz/lin² (g/m²)</td>
<td>ASTM D 4632</td>
<td>1/90,000 ft²</td>
<td>170 (755)</td>
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<td>Grab Tensile, lb (N)</td>
<td>ASTM D 4833</td>
<td>1/90,000 ft²</td>
<td>90 (395)</td>
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<td>Puncture Strength, lb (N)</td>
<td>ASTM D 4751</td>
<td>1/540,000 ft²</td>
<td>70 (0.212)</td>
</tr>
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<td>AOS, US Sieve (mm)</td>
<td>ASTM D 4491</td>
<td>1/540,000 ft²</td>
<td>1.5</td>
</tr>
<tr>
<td>Permeability, (sec)</td>
<td>ASTM D 4355 (after 500 hours)</td>
<td>110 (4,480)</td>
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<tr>
<td>Flow Rate, gpm/ft² (lpm/m²)</td>
<td>ASTM D 4291</td>
<td>1/540,000 ft²</td>
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</table>

NOTES:

a These are MARV values that are based on the cumulative results of specimens tested and determined by GSE. AOS in mm is a maximum average roll value.

b Gradient of 0.1, normal load of 10,000 psf, water at 70° F between steel plates for 15 minutes.

c Roll widths and lengths have a tolerance of ±1%.

d Component properties prior to lamination.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The geocomposite shall be installed in accordance with the Manufacturer's recommended procedures.

B. The CQA Monitor shall verify that all geocomposite rolls and underlying layers are free from deleterious material or debris prior to deployment.

C. The geocomposite panels shall be positioned to minimize wrinkles.

D. No personnel working on the geocomposite shall smoke, wear damaging shoes, or engage in other activities that could damage the geocomposite. No equipment or tools shall damage the geocomposite by handling, trafficking, or other means.

E. The Contractor is responsible for anchoring exposed geocomposite to protect against wind damage until subsequent layers are placed.
F. The geocomposite shall only be cut utilizing methods and tools (i.e., a hooked utility blade) which will not damage the geocomposite or other previous work.

G. Each component of the geocomposite will be secured or seamed to the like component at overlaps.

H. Geocomposite components
   1. Adjacent edges of the geonet along the length of the geocomposite roll shall be placed with the edges of each geonet butted against each other.
   2. The overlaps shall be joined by tying the geonet structure with cable ties. These ties shall be spaced every five (5) feet along the roll length.
   3. Adjoining geocomposite rolls (end to end) across the roll width should be shingled down in the direction of the slope, with the geonet portion on the top overlapping the geonet portion of the bottom geocomposite a minimum of 12-inches across the roll width. The geonet portion on end-to-end seams shall be tied every 6 inches.

I. During placement of geocomposite, care shall be taken not to entrap stones, excessive dust, or moisture that could damage the underlying or overlying geosynthetics, or cause clogging of drains or filters.

J. Following the installation of all geocomposite, an examination of the entire surface shall be conducted to detect potentially harmful foreign objects. Any such foreign objects found shall be removed or the panel shall be replaced by the Contractor.

K. The Contractor shall be responsible for field handling, storing, deploying, seaming, or joining, temporary restraining (against wind), anchoring, and other aspects of geocomposite installation.

L. The Contractor shall accept and retain full responsibility for all materials and installation and shall be held responsible for any defects in the completed systems.

3.2 FIELD QUALITY CONTROL

A. Field inspection and testing shall be performed in accordance with the CQA plan and as indicated in the Contract Documents. The GEOSYNTHETICS INSTALLER shall designate a full-time QC technician who shall be responsible for supervising and/or conducting the field QC program. The QC technician may not be replaced without written authorization by the Manager.

3.3 PROTECTION

A. The Contractor shall place all soil materials in such a manner as to ensure that:
   1. The geocomposite and underlying materials are not damaged
   2. Minimal slippage occurs between the geocomposite and the underlying geosynthetic layers
   3. Excess tensile stresses are not developed in the geocomposite, such as by earth moving equipment making sudden sharp starts, stops, or turns.
allowable ground pressure for equipment shall be prescribed by CQA MANAGER for the material type and layer thickness

4. Minimal movement and wrinkling or folding of the underlying geosynthetic layer occurs

3.4 REPAIRS

A. Any defects observed in the geocomposite shall be brought to the attention of the CQA MANAGER.

B. Any defects in the geocomposite shall be repaired per the Manufacturer's specifications as approved by the CQA MANAGER.

C. Holes or tears in the geocomposite shall be removed and patched. The patch shall be secured to the original geonet by tying every 6 inches with the approved tying devices. If the area to be repaired is more than 50 percent of the width of the panel, the damaged area shall be cut out and the two portions of the geonet shall be cut out and the two portions of the geonet shall be joined in accordance with end-to-end seaming.

** END OF SECTION **
PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope
1. This section describes the general requirements for the manufacture, supply, installation, and quality control of the geosynthetic clay liner (GCL) associated with the Work.
2. The GCL will be procured directly by the OWNER from the GEOSYNTHETICS MANUFACTURER. The CONTRACTOR shall be responsible for unloading and storing the GCL prior to installation. All GCL shall be installed by the GEOSYNTHETICS INSTALLER.

B Related Sections
1. Section 31 05 19.13 Geotextiles for Earthwork
2. Section 31 05 19.16 Geomembranes for Earthwork
3. Section 31 23 00 Excavation and Fill

1.2 REFERENCES

A. Latest Version of American Society for Testing and Materials (ASTM) standards:
1. ASTM D4632 Standard Test Method for Breaking Load and Elongation of Geotextiles (Grab Method)
2. ASTM D5084 Standard Test Method of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
3. ASTM D5261 Standard Test Method for Measuring Mass Per Unit Area of Geotextiles
4. ASTM D6243 Determining the Internal & Interface Shear Strength of Geosynthetic Clay Liner by the Direct Shear Method
5. ASTM D5887 Standard Test Method for Measurement of Index Flux Through Saturated GCL Specimens Using a Flexible Wall Permeameter
6. ASTM D5888 Standard Guide for Storage and Handling of GCLs
9. ASTM D5993 Standard Test Method for Mass Per Unit Area of GCLs
10. ASTM D6072 Standard Guide for Installation of GCLs

B. GRI GCL-3 Standard Test Method for GCL Overlap Seam Permeability

1.3 PRE-QUALIFICATION

A. The GEOSYNTHETICS INSTALLER shall pre-qualify for geosynthetic installation by providing the following qualification documentation:
1. The GEOSYNTHETICS INSTALLER shall have a minimum of 10,000,000 square feet (sf) of HDPE geosynthetic cumulative installation experience.
2. The GEOSYNTHETICS INSTALLER shall provide at least three references from prior installation projects in excess of 500,000 sf including the following information:
   a. Client’s name, address, phone number and contact or representatives name.
   b. Project site and description.
   c. Geosynthetic type(s) and quantity installed.

1.4 SUBMITTALS

A. GEOSYNTHETICS MANUFACTURER shall submit to the CQA MANAGER the following information relating to the GCL a minimum of fourteen (14) calendar days prior to shipment to the site:
   1. Quality Control Program:
      a. Certificates issued by the raw material supplier including the production dates of the raw material used to manufacture the geosynthetic clay liner.
      b. Certificates for each shift’s production of GCL, and statements of production dates.
      c. The quality control certificates shall include:
         i. Roll numbers and identification;
         ii. Sampling procedures; and
         iii. Results of quality control tests, including descriptions of the test methods used.
      d. The results of the manufacturing quality control tests shall meet or exceed the property values listed in Table 31 05 19.23-1.

B. Prior to mobilization of the GEOSYNTHETICS INSTALLER to the Site, the GEOSYNTHETICS INSTALLER shall submit the following:
   1. Shop drawings indicating panel layout and field seams. Each panel shall be assigned an identification number.
   2. Installation schedule.
   3. Copy of GEOSYNTHETICS INSTALLER letter of approval or license by the GEOSYNTHETICS MANUFACTURER.
   4. Proposed installation capabilities, including:
      a. Information on equipment proposed for this project;
      b. Average daily production anticipated for this project; and
      c. Quality control procedures.
   5. Resume of the superintendent and Quality Control Inspector for GEOSYNTHETICS INSTALLER to be assigned to this project, including dates and duration of employment. Substitution of these key personnel, without prior notification and approval by CQA MANAGER will be sufficient grounds for removal of GEOSYNTHETICS INSTALLER from the Project.
   6. Resumes of all GEOSYNTHETICS INSTALLER personnel who will perform seaming operations on this project, including dates and duration of employment.

C. Immediately upon Notice of Award, CONTRACTOR shall make available to the CQA MANAGER samples of the GCL for interface shear testing and conformance testing.
D. During the installation, the GEOSYNTHETICS INSTALLER shall be responsible for the timely submission to the CQA MANAGER of subgrade acceptance certificates, signed by the GEOSYNTHETICS INSTALLER and CONTRACTOR, for each area to be covered by geosynthetic clay liner and geomembrane.

1.5 QUALITY ASSURANCE

A. All Work shall be constructed, monitored, and tested in accordance with the CQA Manual. The CONTRACTOR, GEOSYNTHETICS INSTALLER and GEOSYNTHETICS MANUFACTURER shall participate and comply with all items in the CQA Manual.

B. GEOSYNTHETICS INSTALLER shall attend a pre-installation conference. Attendance of parties directly affecting the WORK of this Section will be mandatory.

C. Conformance Testing
   1. Material shall be made available to the CQA MANAGER after notice to proceed for sampling and conformance testing by the CQA MANAGER at a minimum frequency of one per 100,000 sf of geosynthetic clay liner continuously produced and supplied to the project with a minimum of one sample per lot.
   2. If a test result is in non-conformance with the Specifications, all material from that production lot represented by the failed test shall be rejected. Rejected material may be minimized by bounding the non-conformance material with additional passing tests conducted by the geosynthetic CQA laboratory. Additional tests and replaced material will be provided at no additional cost to the OWNER. No material shall be shipped until confirmation from the CQA MANAGER that samples have passed conformance testing.

1.6 DELIVERY, STORAGE, AND HANDLING

A. CONTRACTOR and GEOSYNTHETICS INSTALLER shall conform to the Manufacturer’s requirements to prevent damage to GCL.

B. Transportation of GCL by the GEOSYNTHETICS MANUFACTURER shall be through an independent trucking firm and shall be shipped via a closed or flatbed trailer.

C. Offloading and storage of the GCL shall be the responsibility of the CONTRACTOR. Handling and care of the GCL after acceptance by the CQA MANAGER, prior to and following installation, will be the responsibility of the GEOSYNTHETICS INSTALLER, until Final Acceptance of the liner system by the CQA MANAGER.

D. Delivery:
   1. GEOSYNTHETICS MANUFACTURER shall deliver materials to the site only after the CQA MANAGER approves the required submittals.
   2. All rolls of GCL delivered to the site shall be identified by the GEOSYNTHETICS MANUFACTURER at the factory with the following:
      a. Manufacturer’s name
      b. Product identification
      c. Lot number
      d. Roll number
3. CQA MANAGER and CONTRACTOR must be present when GCL is delivered to the site. GEOSYNTHETICS MANUFACTURER shall notify CQA MANAGER a minimum of 2 business days prior to delivery.
4. CONTRACTOR is responsible for separating damaged rolls from undamaged rolls and storing at locations designated by the CQA MANAGER until proper disposition of material is determined by the OWNER and the CQA MANAGER.
5. The OWNER will be the final authority regarding damage.
6. CONTRACTOR shall separate rolls without proper documentation and store until the CQA MANAGER approval is received. Rolls or pallets without proper identification by GEOSYNTHETICS MANUFACTURER shall be subject to rejection.

E. On-site Storage:
1. CONTRACTOR shall store in space allocated by the OWNER.
2. Protect from puncture, dirt, grease, water, moisture, mud, mechanical abrasions, excessive heat or other damage.
3. Store on level prepared surface (not on wooden pallets).
4. Stack per Manufacturer's recommendation but no more than three rolls high.
5. CONTRACTOR shall preserve integrity and readability of the GCL roll labels, and store such that CQA MANAGER shall have access to the package slips or roll labels for each roll to verify roll acceptance.

F. On-site Handling:
1. GEOSYNTHETICS INSTALLER shall use appropriate handling equipment to load, move or deploy GCL rolls. Appropriate handling equipment includes cloth chokers and spreader bar for loading, spreader and roll bars for deployment. Dragging panels on ground surface will not be permitted.
2. GEOSYNTHETICS INSTALLER shall not fold GCL material; folded material shall be rejected.

G. Damaged GCL:
1. GCL damage will be documented by the CQA MANAGER.
2. GCL found damaged upon arrival at the site shall be replaced by the GEOSYNTHETICS MANUFACTURER at no additional cost to the OWNER.

PART 2 - PRODUCTS

2.1 GEOSYNTHETIC CLAY LINER

A. The geosynthetic clay liner shall be GSE BentoLiner NWL, as manufactured by GSE Environmental, or ENGINEER-approved equal. The geosynthetic clay liner shall be formulated and manufactured from polypropylene geotextiles and high swelling, polymer-enhanced granular sodium bentonite.

B. Specifications for GCL properties are presented in Table 31 05 19.23-1 below. Supplied material shall conform to these properties based upon the Manufacturer's QC testing and CQA conformance testing.
### TABLE 31 05 19.23-1
GCL PROPERTIES

<table>
<thead>
<tr>
<th>Property</th>
<th>Units</th>
<th>Test Method</th>
<th>Value</th>
<th>Minimum Manufacturer QC Test Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Geotextile Properties</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Cap Nonwoven, Mass/Unit Area</td>
<td>oz/yd²</td>
<td>ASTM D5261</td>
<td>6 (min. avg.)</td>
<td>25,000 yd²</td>
</tr>
<tr>
<td>2. Scrim Nonwoven, Mass/Unit Area</td>
<td>oz/yd²</td>
<td>ASTM D5261</td>
<td>6 (min. avg.)</td>
<td>25,000 yd²</td>
</tr>
<tr>
<td><strong>Bentonite Properties</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Swell Index</td>
<td>ml/2 g</td>
<td>ASTM D5890</td>
<td>24</td>
<td>50 tons</td>
</tr>
<tr>
<td>2. Fluid Loss</td>
<td>ml</td>
<td>ASTM D5891</td>
<td>18</td>
<td>50 tons</td>
</tr>
<tr>
<td><strong>Finished GCL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Bentonite, Mass/Unit Area¹</td>
<td>lb/ft²</td>
<td>ASTM D5993</td>
<td>0.75 (min. avg.)</td>
<td>5,000 yd²</td>
</tr>
<tr>
<td>2. Tensile Strength²</td>
<td>lb/in</td>
<td>ASTM D6768</td>
<td>45 (min. avg.)</td>
<td>25,000 yd²</td>
</tr>
<tr>
<td>3. Peel Strength</td>
<td>lb/in</td>
<td>ASTM D6496</td>
<td>3.5 (min. avg.)</td>
<td>5,000 yd²</td>
</tr>
<tr>
<td>4. Hydraulic Conductivity³</td>
<td>cm/sec</td>
<td>ASTM D5887</td>
<td>5x10⁻⁹ (max.)</td>
<td>30,000 yd²</td>
</tr>
<tr>
<td>5. Index Flux</td>
<td>m³/m²/sec</td>
<td>ASTM D5887</td>
<td>1x10⁻⁸ (max.)</td>
<td>30,000 yd²</td>
</tr>
</tbody>
</table>

**Notes:**

1. At 0% moisture content.
2. Tested in machine direction.
3. Deaired, deionized water @ 5 psi maximum effective confining stress and 2 psi head pressure.

C. The GCL shall be manufactured by mechanically bonding the geotextiles using a needlepunching process to enhance frictional and internal shear strength characteristics. No glues or adhesives shall be used in lieu of the needlepunch process.

D. The needlepunched GCL shall thermally heat set the nonwoven fibers where they protrude from the second geotextile to more permanently secure the reinforcement in place. Other means may be used to lock the fibers in place if the process demonstrates similar performance to the thermal heat set process.

E. No disassociation of geotextile components from the bentonite core shall occur. A sample of the bentonite GCL placed in 70° F tap water for 1 hour shall not delaminate.

F. A minimum overlap guide-line and a construction match-line delineating the overlap zone shall be imprinted with non-toxic ink on both edges of the GCL panel to ensure the accuracy of the seam.

**PART 3 – EXECUTION**

**3.1 SUBGRADE ACCEPTANCE**

A. The GEOSYNTHETICS INSTALLER, on a daily basis, shall certify in writing that the surface on which the GCL will be installed is acceptable. It will be the CONTRACTOR’S responsibility to maintain, protect, and, if required, return the
subgrade in the condition that was originally accepted prior to GCL deployment until accepted by the CQA ENGINEER and GEOSYNTHETICS INSTALLER.

3.2 ANCHOR TRENCH

A. The CONTRACTOR shall excavate anchor trenches to the lines, grades, and widths shown on the drawings, prior to GCL placement. The CQA ENGINEER shall verify that the anchor trench has been constructed according to the Contract Drawings.

B. Slightly rounded corners shall be provided in the trench where the GCL adjoins the trench so as to avoid sharp bends in the GCL.

C. Care shall be taken when backfilling the trenches to prevent any damage to the GCL. At no time shall construction equipment come into direct contact with the GCL. If damage occurs, it shall be repaired by the Installer prior to the completion of backfilling.

D. Extend GCL into the anchor trench as shown in the Contract Drawings. The GCL shall be seamed along the entire distance of the anchor trench to the termination of the GCL panel, using approved methods described in this Section.

3.3 GCL DEPLOYMENT AND SEAMING

A. GCL panels shall be pulled from the roll suspended at the crest of the slope.

B. The GCL shall be overlapped in accordance with the GEOSYNTHETICS MANUFACTURER’s recommended procedures. As a minimum, the overlap shall be 12 inches along the length of the geosynthetic clay liner panel and 18 inches along the width of the geosynthetic clay liner panel on side slopes. As a minimum, the overlap shall be 6 inches along the length of the geosynthetic clay liner panel and 12 inches along the width of the geosynthetic clay liner panel on floor.

C. Displaced panels shall be adjusted to the correct position and orientation. The adjusted panel shall then be inspected for any geotextile damage or bentonite loss. Damage shall be repaired by the above procedure.

D. Place only as much GCL each day as can be covered with HDPE geomembrane liner. The GCL shall be covered by HDPE geomembrane liner at the end of each working day.

E. GCL shall be deployed so that panel seams are parallel to the dip of the slope.

F. Seams shall be perpendicular to toe of slope at all times.

G. Seams at the base of the slope shall be a minimum of 5 feet from the toe.

H. Seams shall be augmented with granular bentonite per the GEOSYNTHETICS MANUFACTURER’s recommendations to ensure seam integrity. Granular bentonite shall be dispersed evenly from the panel edge to the lap line at a minimum rate of ¼ pound per lineal foot continuously along all seams of overlap area. Accessory bentonite shall be of the same type of material used in the production of the geosynthetic clay liner itself.
I. In the event a roll end seam or joint cannot be avoided and occurs on a slope (>10%), construction adhesive shall be used in the lap area with the overlap increased to 24 inches in a rainflap (shingled) orientation.

J. Do not drag textured geomembranes across previously installed GCL. Use a smooth rub sheet between the GCL and the geomembrane, or other methods, to prevent damage. Remove rub sheet when geomembrane is in position.

K. The geosynthetic clay liner materials shall not be allowed to become wetted (except by the subgrade) prior to the placement of the geomembrane. All hydrated GCL shall be removed and replaced by the GEOSYNTHETICS INSTALLER at no additional cost to the OWNER.

L. For all penetrations in the geosynthetic clay liner, a small notch (approximately 3 inches wide and 8 inches deep) shall be cut along the edge of the area. The liner shall be brought up to the appurtenance and trimmed to fit into the notch. The GEOSYNTHETICS INSTALLER shall then hand apply pure bead of bentonite, or compact a mixture of 1 part bentonite to 4 parts soil (by volume), blended dry, into half of the notch. The liner shall then be inserted into the notch, with the remaining area in the notch refilled with the pure bentonite or the 1 to 4 mixture and compacted.

M. To avoid sharp bends in the geosynthetic clay liner, bevel the leading edges of the anchor trench.

3.4 GCL REPAIR

A. Prior to cover material placement, damage to the GCL shall be identified and repaired by the GEOSYNTHETICS INSTALLER. Damage is defined as any rips or tears in the geotextiles, delamination of geotextiles or a displaced panel.

B. Rips or tears may be repaired by completely exposing the affected area, removing all foreign objects or soil, and by then placing a patch cut from unused GCL over the damage (damaged material may be left in place), with a minimum overlap of 12 inches on all edges. Accessory bentonite should be placed between the patch edges and the repaired material at a rate of a quarter pound per lineal foot of edge spread in a continuous six inch fillet.

C. Damaged GCL material on slopes shall be repaired by the same procedures above, however, patch shall overlap the edges of the hole or tear by a minimum of 24 inches in all directions and the edges of the patch should also be adhered to the repaired liner with an adhesive to keep the patch in position during backfill or cover operations.

D. All repairs shall be made at no additional cost to the OWNER.

3.5 FIELD QUALITY CONTROL

A. Field inspection and testing shall be performed in accordance with the CQA MANUAL and as indicated in the Contract Documents. The GEOSYNTHETICS INSTALLER shall designate a full-time quality control (QC) technician who shall be
responsible for supervising and/or conducting the field quality control program. The QC technician may not be replaced without written authorization by the CQA MANAGER.

3.6 SURVEY CONTROL

A. CQA MANAGER will perform survey of final surface area of geosynthetics to determine quantities for payment purposes.

B. GEOSYNTHETICS INSTALLER shall provide CONTRACTOR and CQA MANAGER with record drawings of geomembrane panel locations and extent of the geomembrane. Drawings shall be submitted in in both electronic and hardcopy format.

***END OF SECTION***
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1.00 VALUE ENGINEERING

A Value Engineering Proposal (“VEP”) is a creative proposal initiated by the Contractor to amend the Contract to use an alternate method, design, material, or similar element, to reduce the project’s cost or improve its outcome for both the City of Cheyenne’s (the “City’s”) and the Contractor’s benefit.

The Contractor may submit a VEP for consideration by the City and the City Engineer (the “Engineer”) after the City awards the contract. The Contractor shall submit a VEP in accordance with the procedure outlined in the current edition of the Wyoming Department of Transportation Standard Specifications for Road and Bridge Construction (“WYDOT Standard Specifications for Road and Bridge Construction”), Subsection 104.3.4, “Submitting a VECP”.

The City will not consider VEPs that are cost reductions resulting from corrections to design errors; that are inconsistent with the City’s design policies and criteria for the project; or that may require excessive time or cost for review.

If the City and the Engineer accept a VEP which results in a net reduction in the contract price, the Contractor will share proportionally with the City in the net savings (City 50%; Contractor 50%), less the cost of the Engineer’s time required to evaluate the VEP. Net savings are defined as savings available after deducting VEP evaluation costs.

2.00 REFERENCES

2.01 Coordination of Contract Documents. Revise City of Cheyenne & Board of Public Utilities Standard Construction Specifications and Standard Drawings, 2014 Edition (“City Standard Specifications and Drawings” or separately as “Standard Specifications” or “Standard Drawings”) Section 01090, REFERENCES, item 1.01.A. as follows, by deleting the hierarchy list included (items 1 thru 4), and replace with the following in order of precedence:

1. Permits from other agencies as required by law;
2. Successive change orders and contract modifications in order of issuance, most recent first;
3. Addenda;
4. Contract;
5. City-obtained agreements;
6. Special Provisions;
7. General Conditions;
8. Project Plans;
9. Standard Drawings;
10. Standard Specifications;
11. Electronic CADD Files; and

Detailed plans shall have precedence over general plans.

2.02 Reference Specifications. The City Standard Specifications and Drawings, and all revisions through the advertisement date, constitute the current Standard Specifications and Standard Drawings for this project. They are an integral part of the Contract and are incorporated herein by reference. The Contractor shall adhere to all requirements and provisions of said City Standard Specifications and Standard Drawings in the performance of this Contract, except where otherwise provided herein or otherwise shown on the Contract Drawings.

Contract references to standard test methods or specifications such as those from the American Association of State Highway and Transportation Officials (“AASHTO”), the American Society for Testing and Materials (“ASTM”), or similar professional organizations, refer to the methods and specifications in effect on the advertised date of the public bid opening. If a later change to a cited document affects successful completion of the project, the City will incorporate the new reference with a contract modification.

All work shown on the Contract Drawings and Standard Specifications which refer to the Wyoming Department of Transportation (“WYDOT”) shall be constructed in accordance with the current editions of the WYDOT Standard Specifications for Road and Bridge Construction and WYDOT Standard Plans and all revisions through the date of advertisement.

It is the bidder’s responsibility to acquire the latest editions of all the Specifications, Standard Drawings, and Manuals.

3.00 TRAFFIC CONTROL

3.01 Construction Phasing. When a construction phasing or traffic control plan is included in the project plans, this plan shall govern unless an alternate plan, acceptable to the City, is submitted to the Engineer by the Contractor. If no traffic control plan is provided or if the Contractor desires to deviate from the provisions for maintaining traffic as described in the contract documents, the Contractor shall submit to the Engineer for approval a proposed sequence of operations and a compatible method of maintaining vehicle, pedestrian, and bicycle traffic. The Contractor shall submit the proposal for review and approval at least ten (10) Working Days prior to its intended implementation. The City reserves the right, in its sole discretion, to reject any construction phasing or traffic control proposal for any reason whatsoever.
3.02 **Traffic Control Requirements.** The Contractor shall provide adequate signs, barricades, lights, flares, flaggers, take all necessary precautions to prevent accident or injury, and minimize the public’s inconvenience while the work is in progress. Any traffic control or construction phasing drawings shown in the project plans are conceptual only. The Contractor shall submit a detailed traffic control diagram to the City for prior approval before work begins. The diagram shall indicate location and type of signs, cones, flashers, flagging, reflective barricades, and all other devices the Contractor deems necessary for the proper protection of the work area. The Contractor shall install and maintain all traffic control and protective devices in accordance with the current edition of the Manual on Uniform Traffic Control Devices for Streets and Highways (“MUTCD”).

3.03 **NotifyingAffected Parties.** The Contractor shall notify all homeowners and businesses it anticipates will be affected by any work no less than two (2) Working Days, as defined by section 7.04, “Working Days and Time”, before work is scheduled to commence. All written notifications shall be approved by the City prior to distribution. The Contractor shall notify all homeowners and businesses again if the work does not begin on the specified day, as anticipated. The notice shall be a written posting, hand delivered to the property, stating the anticipated start-date and duration of such work containing parking restriction information, and a phone number for the Superintendent or Project Manager. The Contractor shall not place notices in mailboxes.

3.04 **Parking Restrictions.** If work requires parking restrictions, the Contractor shall place “No Parking” signs along the affected area a minimum of forty-eight (48) hours prior to the beginning of work. The Contractor shall place “No Parking” signs a maximum of seventy-five (75) feet apart, but at no time fewer than two per block, per side. The City will only tow vehicles from the work area if they remain parked on the street after the Contractor provided proper written notice and placed “No Parking” signs. If the Contractor provides insufficient notice to affected parties, the Engineer must approve towing vehicles parked on the street, and such towing shall be at the Contractor’s expense.

3.05 **Traffic Disruption and Obstructions.** The Contractor shall minimize obstructions to vehicle, pedestrian, and bicycle traffic; minimize disruption to transit routes; and give consideration to the location of detours and provisions for handling traffic. The Contractor shall provide for the safety and convenience of both the general public and residents near the work. The Contractor’s travel rights do not supersede the public’s travel rights.

Whenever, in the Engineer’s opinion, the Contractor has not provided sufficient or proper safety precautions, the Contractor shall do so immediately and to whatever extent the Engineer requires. This provision shall not be construed as creating any duty on the part of the Engineer for traffic safety.

Fire hydrants on or near the site of the work shall be accessible at all times.
The Contractor shall not close any streets, driveways, access points, or any transit stops without prior consent of the City, Engineer, and proper governmental authorities affected by the closure or having authority over such area. The Contractor is required to request approval from the Engineer at least five (5) Working Days prior to the planned date of physical closure of any street or transit stop. Submittal or approval of a traffic control plan alone does not constitute notice or approval of the date of start of closure.

3.06 **Property Access.** The Contractor shall provide temporary approaches to businesses and residences adjacent to the roadway, intersections, detours, crossings, or similar features or facilities to safely accommodate customary vehicular or pedestrian traffic affected by the work.

3.07 **Emergency Access.** The Contractor shall be prepared at all times to provide immediate access for emergency vehicles to any buildings or other areas adjacent to the project and shall, upon emergency personnel request, construct temporary ramps and other facilities required for such emergency access. The City will make no additional payment to the Contractor for any delays or cost incurred by the Contractor in providing such emergency access.

4.00 **CONTROL OF WORK**

4.01 **Construction Stakes, Lines, and Grades.** The Contractor shall provide all construction surveying and stakeout required to accurately build and complete the project. The Engineer will establish primary project control only, but if the Engineer determines that additional project control is needed, the Engineer may direct the Contractor to establish additional project control under the direct supervision of a licensed Wyoming Professional Land Surveyor. The Engineer may provide an electronic point file or CADD files to the Contractor for use in construction staking.

The Contractor shall preserve all survey stakes and marks. If any of the primary project control survey marks are destroyed or disturbed due to the Contractor’s construction activities or negligence, the Contractor shall be charged at the Engineer’s established hourly crew rate for replacing them, with payment for this extra work made directly to the City’s Consultant by deduction from the monthly periodic estimate payments to the Contractor. The Contractor shall also be responsible for any mistakes or damage resulting from the unnecessary loss or disturbances of control points, offset line points, and stakes.

The Contractor is responsible for scheduling all surveying and shall consider all phasing, sequencing, and construction limits required by all specifications. The Contractor shall review the survey stakes to ensure there is no discrepancy between the drawings and the survey stakes. If there is a discrepancy, the Contractor shall stop work immediately and notify the Engineer without delay.
The Contractor shall provide the survey data to the Engineer to verify elevations, resolve grade issues, and to otherwise use as the Engineer deems necessary or appropriate. The Engineer has the right to review the project stakeout prior to staking. The Contractor shall arrange work to allow forty-eight (48) hours advance notice for the Engineer to review the lines and grades of those stakes set for the next step of the Contractor’s work. The Engineer shall have the right to make reasonable changes in the grades as shown on the drawings. The Engineer will be available for consultation and interpretations for staking operations.

The Contractor shall call to the Engineer’s attention any reference lines, points, or bench marks, which may have been disturbed or appear off line or grade.

A licensed Wyoming Professional Land Surveyor shall directly supervise all construction surveys. The costs for providing all construction surveying and staking shall be considered included in the cost of contract items.

4.02 Land Provided by the City. The City or Engineer will obtain all easements and franchises required for the work. The Contractor shall limit operations to the area obtained and shall not trespass on private property. The City may provide access to certain lands, as indicated in connection with the work under the contract. The Contractor shall not conduct any activity on any land which may result in the imposition of any lien or encumbrance. The Contractor shall use said land in accordance with conditions established by the City.

4.03 Land Provided by the Contractor. If the Contractor requires additional area required for temporary construction facilities or storage of materials, the Contractor shall obtain written consent and agreement from the landowner on whose land the Contractor seeks to expand the Contractor’s operation. The Contractor must provide a copy of this agreement to the Engineer, who may grant or deny permission to expand to additional land. The agreement, if accepted by the Engineer, must describe the activity for which the land will be used and how the Contractor will restore the land.

The Contractor shall construct all access roads, detour roads, or other temporary works, as required by the operations. The Contractor shall confine its equipment, materials storage, and worker operations to those areas shown and described, and such additional areas as the Contractor may provide. The Contractor shall provide such land, and access thereto, without liability to the City.

Prior to final payment, the Contractor shall furnish the Engineer with a written statement of clearance from the landowner for those properties on which work, equipment, or material staging took place.
4.04 Protection and Restoration of Property, Markers, and Landscape.

General: All construction work under this contract on rights-of-way, easements, or franchise, shall be confined to the limits of such rights-of-way, easements, or franchise. The Contractor shall accomplish all work so as to cause the least amount of disturbance and a minimum amount of damage. The Contractor shall take all necessary precautions to preserve and protect adjacent roadways, public and private properties and improvements, and underground facilities during work on the project. The Contractor shall take responsibility for any damage or injury resulting from:

1. Any act, omission, negligence, or misconduct in the execution of the work;
2. Defective work or materials; and
3. The work of a Subcontractor.

Except for damage due to unforeseeable causes beyond the control of, and without fault of negligence of the Contractor, the Contractor shall rebuild, repair, restore, and make good damages to any portion of the project or real property injured in the course of the work, from any cause before final acceptance, and without additional cost to the City.

The Contractor shall coordinate such repairs, replacements, or both, of real property with the affected property owner, and obtain the property owner’s written approval when the final work is complete. A copy of the property owner’s approval shall be submitted to the City. If the Contractor fails to perform such restoration within a reasonable time, the City may do so and deduct the cost from monies due the Contractor or bill the Contractor, as appropriate.

The Contractor’s responsibility for the work lasts until final written acceptance of the project by the City, in accordance with General Conditions regarding Completion and Warranty.

Site security: The Contractor shall provide site security in accordance with Special Provisions Section 01231, SAFETY. Suspension of work does not relieve the Contractor of responsibility for the project, except in accordance with General Conditions provisions on Suspension of Work.

Vehicle Damage Claims: If a vehicle owner makes a vehicle damage claim, the Contractor shall send a written response to the claimant addressing the claim and the actions the Contractor has taken or intends to take. The Contractor shall send a copy of the response letter to the following address:

City of Cheyenne Risk Management
Attn: Risk Manager
2101 O’Neil Ave
Cheyenne, WY 82001
Trenches: The Contractor shall not leave trenches open across travel ways for more than twenty-four (24) hours or over weekends or holidays. Trenches that present a danger to vehicular or pedestrian traffic shall be backfilled or barricaded at the end of each day's work.

Structures: The Contractor shall remove such existing structures as may be necessary for the performance of the work and, if required, shall rebuild the structures thus removed in as good a condition as found with minimum requirements as herein specified. The Contractor shall also repair all existing structures damaged as a result of the work under this contract.

Cultivated Areas and Other Surface Improvements: All cultivated areas, either agricultural or lawns, and other surface improvements damaged by Contractor’s actions shall be restored as nearly as possible to their original condition and in accordance with Standard Specification, Section 02900, Landscaping. Prior to excavation on an easement or private right-of-way, the Contractor shall strip topsoil from the trench or construction area and stockpile it in such a manner that it may be replaced by the Contractor upon completion of construction. Ornamental trees and shrubbery shall be carefully removed, with the earth surrounding their roots, wrapped in burlap and replanted in their original positions within twenty-four (24) hours. The Contractor shall replace all shrubbery or trees destroyed or damaged with material of equal quality at no additional cost to the City or property owner.

In the event that it is necessary to trench through any lawn areas, the sod shall be carefully cut, rolled, and replaced after the trenches are backfilled. The Contractor shall then clean the lawn area of debris by raking or other means. All fences, markers, mail boxes, or other temporary structures shall be removed by the Contractor and immediately replaced after the trench has been backfilled, in their original positions. The Contractor shall notify the Engineer and property owner at least twenty-four (24) hours in advance of any work done on easements or private rights-of-way.

Streets: The Contractor shall assume all responsibility for restoration of the surface of all streets (travel ways) used by the Contractor and damaged.

4.05 Cooperation by the Contractor. Contact and Emergency Response: The Contractor shall maintain a telephone for the duration of the contract, at the Contractor’s own expense, where the Contractor or the Contractor’s authorized representative may be reached directly or by message at all times, including weekends and holidays. The Contractor shall cooperate with the Engineer and inspectors at all times and shall respond to requests for emergency repairs to the contract work no later than two (2) hours of the request.

If the Contractor does not respond to requests for emergency repairs within the time allotted, the City reserves the right to enter the work area and conduct repairs with
City forces or City-hired forces. The Contractor will be responsible for all costs incurred by the City in responding to the emergency repairs and will also be responsible for restoring all work back to the required contract conditions. The City will not be responsible for any damages to the Contractor’s work or equipment that results from the City responding to the emergency repair.

Superintendence: When work is underway, including work by a Subcontractor, the Contractor shall ensure the presence of a competent project superintendent, who is an employee of the Contractor, at the worksite at all times, unless otherwise agreed to by the City. The project superintendent shall have the ability to communicate clearly; to read, interpret, and implement the relevant contract documents; have experience in the work included in the project; have authority to represent and act for the Contractor, including authority to execute the Engineer’s directions; and authority to obtain and provide sufficient materials, equipment, tools, labor, and incidentals to complete the project as specified.

4.06 Cooperation between Contractors. The City may contract with separate Contractors for additional work on or near the worksite. When separate contracts are let, the City requires each Contractor to cooperate with and work without hindering each other.

Each Contractor assumes liability, financial or otherwise, for its own errors, acts, or omissions and holds the City harmless, in accordance with the General Conditions of the Contract, from damages or disputes arising from inconvenience, delay, or loss due to the presence and operations of other persons, contractors or public entities on or near the worksite.

4.07 Maintenance during Construction. The following shall be added to Standard Specification Section 01054.1.09:

The Contractor is responsible for snow removal within all barricaded areas of the project. The Contractor will be responsible for snow removal within the travel way of the project area unless a minimum of a 16’ lane is provided for the City plows.

5.00 CONTROL OF MATERIAL

5.01 Inspection and Testing for Quality Control. Requirements: All materials and work shall be tested and inspected in accordance with the specifications. The Contractor shall provide testing and inspection services to verify compliance with requirements specified or indicated. The Contractor shall be responsible for scheduling inspections and tests and notifying the laboratory.

The Contractor shall provide advance notification to the Engineer of any testing or sampling to be conducted. The Engineer may provide Quality Assurance testing to prevent against defects and deficiencies in the Contractor’s work by verifying that
the Contractor’s Quality Control testing is accurate and adequate. However, furnishing such Quality Assurance testing shall not relieve the Contractor of responsibility for providing Quality Control testing or responsibility for the Contractor’s failure to perform the work in accordance with the contract documents.

**Laboratory Requirements:** The Contractor shall retain the services of an Independent AASHTO-accredited testing laboratory to inspect, sample and test the related work. The testing laboratory shall cooperate with the Engineer and the Contractor in performing its duties and shall provide qualified and/or certified personnel to perform inspections and tests.

Tests shall be performed in accordance with the most recent cited standard methods of AASHTO or ASTM, approved AASHTO Interim Specifications, or ASTM Tentative Specifications in effect on the advertised date of the public bid opening or more stringent Quality Control requirements where specified in the Special Provisions.

The testing laboratory shall promptly notify the Engineer and the Contractor of deficiencies in the work observed during the performance of its duties. The testing laboratory shall not approve or accept any portion of the work nor shall it perform any duties of the Contractor.

**Submittals:** The testing laboratory shall submit a certified written report of each inspection and test to the Engineer, Contractor, and any other entities designated by the City. Copies of all test results shall be provided to the City within twenty-four (24) hours of the availability of the test results with written report to follow within seven (7) Working Days. Reports of each inspection, test, or similar service shall include the following:

1. Name, address, and telephone number of testing laboratory.
2. Project title and project number.
3. Date of report and designation (number).
4. Dates of testing and maps with sufficient detail to accurately identify locations where samples were taken or inspections and field tests made.
5. Ambient conditions at the time of sample taking and inspecting, or field testing.
6. Names of individuals taking the sample or making the inspection or test.
7. Product and test method.
8. Inspection or test data including interpretation of test results and comments or professional opinion on whether inspected or tested work complies with requirements.
9. Recommendations on retesting or re-inspections.
10. Name and signature of laboratory inspector.

**5.02 Unacceptable Materials.** The Contractor shall not undertake any work in which untested or non-conforming materials are used without prior, written, express approval from the Engineer. Any such work undertaken using untested or non-
conforming materials without the prior, written, express approval of the Engineer may be considered in material breach of this contract and, if directed by the City, shall be removed at no additional cost to the City.

5.03 **Storage of Materials.** Materials shall be stored, in accordance with manufacturer’s recommendations, and handled in a manner that facilitates inspections and preserves the materials’ quality and suitability for use. Material shall be transported in vehicles built to prevent loss, contamination, or segregation after loading and measuring. The Engineer may re-inspect stored, previously inspected materials before approving their use in the work.

As approved by the City, that portion of the right-of-way within the project limits not required for public travel may be used for storage purposes and for placing of the Contractor’s plant and equipment. Material stored on or adjacent to public streets shall not create a safety hazard, obstruct, or inconvenience the traveling public. Any additional space required must be provided by the Contractor at the Contractor’s expense. Private or public property shall not be used for storage purposes without written permission of the owner or lessee. All storage sites shall be restored to their original condition by the Contractor at the Contractor’s sole expense. Construction materials may not be stored in streets, roads, or highways for more than five (5) days after unloading. All materials or equipment not installed or used in the construction within five (5) days after unloading shall be stored elsewhere by the Contractor at the Contractor’s expense, unless the Engineer authorizes additional storage time.

Excavated material, except that which is to be used as backfill in the adjacent trench, may not be stored in public streets, roads, or highways unless the Engineer authorizes such storage. Erosion control shall be provided around all excavated or backfill material. After placing backfill, all excess material shall be removed immediately from the site.

5.04 **City-Furnished Material.** If specified in the Special Provisions, the City will provide material for incorporation into the project. Materials furnished by the City will be delivered, or made available to the Contractor, at the locations specified in the Special Provisions.

The cost of handling and placing all materials supplied by the City shall be considered as included in the contract price for the item in connection with which they are used.

The Contractor shall be held responsible for all material delivered to him, and deductions shall be made from any money due to make good any shortages or deficiencies, from any cause whatsoever and for any damage which may occur after such delivery and for any demurrage charges.

5.05 **Rights In and Use of Material Found in the Work.** The City may authorize the
use of aggregate or other material found in excavation for use in another pay item. The City will pay the established contract unit price for excavation of such material and for the pay item for which it was used. If the excavated material is used for another pay item but was otherwise needed for embankments, backfills, approaches, or other purposes, the Contractor shall provide an acceptable replacement at no additional cost to the City.

The Contractor shall not excavate or take material outside the slope stake limits without the City’s prior written approval. The right to use and process material found within the project limits excludes use and processing for noncontract work. If the Contractor produces or processes more material from the project than is required for the contract, without additional compensation to the Contractor, the City may take possession of the excess material and direct its use; or require removal of the material and restoration of the land to a satisfactory condition.

5.06 **Removal and Salvage of Materials.** Any equipment, hardware, structures, inlet grates, valve boxes, manhole rings, covers and lids, traffic control standards, signs and posts, fence and any other miscellaneous items designated for removal from the site and salvage to the City shall be removed from the site and taken to a location designated by the City. All such materials shall be the property of the City unless otherwise specified. Diligent care shall be taken during the removal of all materials to prevent damage.

Manhole covers and manhole rings designated for salvage shall be both plainly marked with a durable, exterior paint for easy identification as individual pairs.

5.07 **Material Spoil Area/Waste Site.** The Contractor shall notify the Engineer at the preconstruction conference as to the location selected to dispose of the excess, waste and unsuitable materials and a map indicating the haul route for the removal from the project.

Lost and spilled materials onto the route taken by the Contractor shall be promptly removed. The route shall be maintained as deemed necessary by the Engineer by the use of water trucks, motor grader, hand labor and related equipment to alleviate the problem of lost spills, tracked mud, and dust control. Prompt restoration of the route is required.

No extra compensation shall be allowed for the disposal of the waste and surplus material; including but not exclusively; dump fees, extra haul distances and time, changed haul routes, and haul road maintenance.

5.08 **Load Restrictions.** The Contractor shall be responsible for all damage to the work caused by the Contractor’s hauling equipment. The Contractor shall comply with legal load restrictions when moving equipment or hauling materials on public roads that remains in service. A permit to operate an overweight, oversized, or over-width vehicle does not relieve the Contractor of liability for damage to public roads due
to the moving of equipment or materials.

The Contractor shall not allow loads on concrete pavement, base, or structures before the strength or time requirements for the concrete have been met. In case of pipes, the Contractor shall not allow loads before placing the specified cover fill.

6.00 RESPONSIBILITY FOR UTILITY PROCEDURES AND SERVICES

6.01 Location. Where underground main distribution conduits such as water, gas, sewer, electric power, telephone or cable are shown on the plans, the Contractor, for the purpose of preparing the Contractor’s bid, shall assume that every property parcel is served by a service connection for each type of utility. Failure by the Engineer to show the location of any utility on the plans shall not relieve the Contractor from the responsibilities below.

Before proceeding with the work, the Contractor shall confirm the final grade and locations of such facilities in accordance with the “Wyoming Underground Facilities Notification Act” and the “Wyoming High Voltage Power Lines and Safety Restrictions Act.”

The Contractor shall notify utility and pipeline companies of the proposed construction schedule at least two (2) Working Days before the start of work. The Contractor shall ask for the nature, location, and depth of pipes and cables and areas where they may conflict with the work. If a company cannot or will not provide this information, the Contractor shall obtain it by alternate means. Where conflicts may exist, the Contractor shall locate the relevant pipes or cables in three dimensions.

The Contractor shall not begin excavation until all such features have been located, their owners notified, and the Engineer has approved. The Contractor shall not interrupt the service function or disturb the supporting base of any utility without authority from the utility owner or an order from the City. Where protection is required to ensure support of utilities, the Contractor shall, unless otherwise provided, furnish and place the necessary protection at no cost to the City.

6.02 Utility Line Conflicts and Damage. If utility lines are determined to be in conflict with or are damaged during the work, the Contractor shall stop work in the immediate area, notify the Engineer and the utility owner, and cooperate with the owner to move or repair the utility. The Contractor shall be solely responsible for any damage done to such utilities due to failure to preserve original locate marks or to properly protect the utilities when their location is known.
7.00 WORK SCHEDULE AND CONDITIONS

7.01 Pre-Construction Conference. The Contractor will schedule and convene, at a mutually convenient time before the start of work, a Preconstruction Conference with, all Subcontractors, Design Engineer and/or City’s Representative, Board of Public Utilities, Power Company, Telephone Company, Gas Company, Cable Television, and other interested parties. Before or at the meeting, the Contractor shall provide the following, if applicable:

1. A letter providing the names, phone numbers and addresses, of material suppliers and Subcontractors;
2. Project Schedule in accordance with the item 7.05 Schedule below;
3. Spill contingency and storm water pollution prevention plans in accordance with Standard Specification Section 01563 Erosion Control and Storm Water Management;
4. A traffic control plan in accordance with Section 01050 Traffic Control;
5. A list with names and phone numbers of key personnel, including the project superintendent and subordinates, authorized to sign contract documents and project records;
6. A list of phone numbers for the Contractor’s personnel the Engineer should call in case of emergency in accordance with item 4.05 Cooperation by the Contractor above; and
7. Other items the Engineer may request.

7.02 Weekly Conference. Subsequently a representative of the Contractor and the Contractor’s Subcontractors (if requested) shall attend a weekly conference at a mutually convenient time and at a place designated by the City to review progress and discuss any problems that may arise or have incurred.

7.03 Work Progress. The Contractor shall make every effort to complete work in a manner and fashion that minimizes roadway closures and inconveniences to the traveling public and adjacent property owners. Progress will be continuously prosecuted on all roadways and drive approaches that have been closed for construction in accordance with Section 01041.1.01.I. of the Standard Specifications.

The Contractor shall not open up work to the prejudice or detriment of work already started. The City may require the Contractor to finish a section on which the work is in progress before work is started on any additional sections if the opening of such section is essential to public convenience.

7.04 Working Days and Time. Normal working hours shall be 7:00 am to 6:00 pm. No work shall be allowed on Saturdays without the City’s prior written permission. For the purposes of time limitations specified in these instructions, a Saturday shall count as a “Working Day” if the City has approved work on that Saturday. No work, except for City-approved emergency repairs, shall be allowed on Sundays or
Holidays. For the purposes of the time limitations in these instructions, neither a Sunday nor a Holiday will count as a “Working Day” even if the City has authorized emergency repairs to be performed on that Sunday or Holiday. If the Contractor desires to perform work beyond the City’s normal working hours, the Contractor must obtain the City's written approval forty-eight (48) hours in advance of scheduled work. In an emergency situation, verbal approval will suffice until the next working day at which time written approval shall be obtained before further inspection work beyond normal working hours will be provided.

Holidays. Normal City holidays are as follows:

<table>
<thead>
<tr>
<th>HOLIDAY</th>
<th>DATE</th>
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<tbody>
<tr>
<td>New Year’s Day</td>
<td>January 1st</td>
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<tr>
<td>Martin Year’s Day</td>
<td>Third Monday in January</td>
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<tr>
<td>President’s Day</td>
<td>Third Monday in February</td>
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<tr>
<td>Memorial Day</td>
<td>Last Monday of May</td>
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<tr>
<td>Independence Day</td>
<td>July 4th</td>
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<tr>
<td>Labor Day</td>
<td>First Monday in September</td>
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<tr>
<td>Veteran’s Day</td>
<td>November 11th</td>
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<tr>
<td>Thanksgiving Day</td>
<td>Fourth Thursday in November</td>
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<tr>
<td>Day after Thanksgiving</td>
<td>Day after Thanksgiving</td>
</tr>
<tr>
<td>Christmas Day</td>
<td>December 25th</td>
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</table>

With the Engineer’s prior written approval, no work shall be permitted the day before, during, and the day after said holidays. The Engineer may require the Contractor to cease construction operations at any other time if the Contractor’s operations are of such nature, the project is so located, or the traffic is of such volume that the Engineer deems it expedient to do so.

Frontier Days. During Cheyenne Frontier Days (CFD), typically the last full week in July, and the week immediately preceding, special rules shall apply in the following designated areas:

1. All roadways contained in the area bounded by 15th St. on the south, Snyder Ave. on the west, Pershing Blvd. on the north, and Van Lennen Ave. on the east, including the roadways making up the boundaries.

2. All roadways contained in the area bounded by Pershing Blvd. on the south, Interstate 25 on the west, the extensions of Manewal Dr. on the north, and Warren Ave./Yellowstone Rd. on the east, including the roadways making up the boundaries.

3. All roadways designated on the functional classification map as “Principal Arterial” or “Minor Arterial”.

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4. All roadways located north of the Union Pacific Railroad tracks designated on the functional classification map as “Major Collector” or “Minor Collector”.

Functional classification maps are available from the Engineer’s Office or the Cheyenne Metropolitan Planning Organization’s website at www.plancheyenne.org.

During the week immediately preceding CFD, the special rules are as follows:

1. Work in the designated areas shall be in a state whereby all facilities are available to the public no later than 5 pm Wednesday of the week immediately preceding CFD;

2. After Wednesday of the week immediately preceding CFD, the only work allowed in designated areas are emergency repairs and operations having a duration of less than one (1) hour (including moving operations, such as striping or street sweeping).

3. All equipment, materials, traffic control devices, and other construction items shall be removed from the designated areas prior to 5 pm Wednesday of the week immediately preceding CFD.

4. All roadways and pedestrian ways shall be in such a condition that there shall be no interference with parades or other CFD event operations.

During CFD:

1. No work will be allowed in the designated areas with the exception of City-approved emergency repairs and moving operations, such as striping or street sweeping.

2. All moving operations must be approved in writing, in advance by the Engineer.

3. Work and traffic control operations can recommence during normal working hours on the Monday morning following the end of CFD.

Exceptions to the above will be made at the Engineer’s sole discretion.

7.05 **Schedule.** The Contractor shall submit a project schedule to the Engineer for review and discussion at the Pre-Construction meeting. This schedule shall be sufficiently detailed to show the following:

1. The activities needed to perform and complete the work, activities that might delay contract completion, and critical activities such as street closures or major traffic restrictions.
2. Sequence of each activity required to complete the project within the contract time allotted and in the manner specified. Interrelationships among activities shall be shown without lead or lag time.

3. The planned start and completion dates for each activity, the duration of each activity with activities of more than fifteen (15) Working Days in duration broken into two or more activities distinguished by location or some other feature.

4. Interim, milestone, and project completion dates specified in the contract.

5. An indication of how the schedule accommodates adverse weather days for each month.

6. Dates related to the procurement of materials, equipment, articles of special manufacture, etc.

7. Dates related to the submission of working drawings, plans, and other data specified for review or approval by the Engineer.

8. Dates related to required special inspections of structural steel fabrications and other specified activities by the City or third parties.

The Contractor shall submit monthly updates to the Project Schedule at the time of the submittal of the monthly Pay Estimate. The schedule update shall include any revised planned start and finish dates for each activity shown on the most recent accepted schedule. For newly started or finished activities, the Contractor shall include the actual start or finish date. For activities previously started and still ongoing, the Contractor shall show the remaining duration and planned finish dates. The City may withhold processing the monthly Pay Estimate until the Contractor submits the monthly update to the Project Schedule.

The Engineer may request a schedule revision at any time for any reason. Circumstances leading to such a request include, but are not limited to, the following:

1. A delay (actual or projected) of partial or contract completion dates by fourteen (14) calendar days or more;

2. A difference between the actual rate of progress and that depicted in the schedule; and

3. Issuance of a contract modification that, by adding, deleting, or revising activities, changes the planned sequence of work or the method and manner of its performance.
7.06 Requirements for Workers, Methods, and Equipment. The Contractor shall at all times provide enough qualified labor and enough capable equipment to complete the project in accordance with the contract.

The Contractor shall provide workers that are sufficiently skilled to perform the work assigned to them. In writing, the City may direct removal from the project of any person, regardless of employer, who is unsafe, incompetent, intemperate, disorderly, or insubordinate. Through written notice, the City may suspend the work for failure of the Contractor to comply with such a directive or for failure to provide enough qualified workers.

All equipment proposed to be used on the work shall be of sufficient size and in such mechanical condition as to meet requirements of the work and to produce a satisfactory quality of work. Equipment used on any portion of the project shall be such that no injury to the roadway, adjacent property, or other improvement will result from its use.

When the methods and equipment to be used by the Contractor in accomplishing the construction are not prescribed in the contract, the Contractor is free to use any methods or equipment that the Contractor demonstrates to the satisfaction of the Engineer will accomplish the contract work in conformity with the requirements of the contract. When the contract specifies that the construction be performed by the use of certain methods and equipment, such methods and equipment shall be used unless others are authorized by the Engineer.

If the Contractor desires to use methods or types of equipment other than those specified in the contract, the Contractor may request authority from the Engineer to do so. The request shall be in writing and shall include a full description of the methods and equipment proposed to be used and an explanation of the reasons for desiring to make the change. Approval does not relieve the Contractor from the requirement to produce work in accordance with the contract documents. The use of alternative methods or equipment resulting in work that fails to meet contract requirements may lead the Engineer to, in writing:

1. Direct a stop in their use;

2. Order the completion of remaining work using the original specified methods or equipment; or

3. Require the removal, at no additional cost to the City, of the unsatisfactory work and its replacement using the original specified methods and equipment.

7.07 Suspension of Work. The City shall have the authority to suspend the work wholly or in part, for such period as may be deemed necessary due to unsuitable weather, due to such other conditions as are considered unfavorable for the suitable prosecution of the work, for failure of the Contractor to correct unsafe conditions,
for failure of the Contractor to carry out orders given, or for failure of the Contractor to perform any provision of the contract.

If the City suspends the work for more than ninety (90) days, through no fault of the Contractor, the Contractor may apply, in writing, for a price adjustment to compensate for reasonable expenses caused by the suspension. Any application for price adjustment or contract time extension will be submitted to the governing body of the City for its consideration in the form of a Contract Modification. It will be the responsibility of the Contractor to provide sufficient documentation to substantiate any claim.

The City will not grant or consider contract modifications based upon City-ordered suspension:

1. Without timely written notice from the Contractor;

2. To the extent that the suspension is overlapped or falls within a suspension or delay due to any other cause, including delays caused by the Contractor; or

3. That includes profit.

The Contractor may ask the City to suspend the project in writing due to unsuitable weather or due to such other conditions as are considered unfavorable for the suitable prosecution of the work. The Contractor shall not suspend operations or remove necessary equipment or materials without approval from the City.

During delays or suspensions, if the traveling surface is a leveling course or non-paved surface, the Contractor shall maintain the roadway for traffic use (including snow removal and placing of sand) and the quality of the surface course until the placement of additional course or temporary surfacing, at no additional cost to the City. If placement of concrete pavement or a full lift of plant mix pavement is not completed before delays or suspension of work, the Contractor shall provide, place, and maintain the temporary plant mix pavement and then remove it at the end of the suspension.

During suspensions, the Contractor shall store materials and equipment, at no additional cost to the City as far from the travel way as possible; at a location that will not cause maintenance or safety problems for the roadway; and at a location where they will be protected from damage. The Contractor shall maintain all living material in new plantings, seeding, and sods in an acceptable growing condition and protect from injury, at no additional cost to the City.

During suspensions, the Contractor shall provide roadway drainage, temporary structures needed for public travel throughout the project, any required temporary traffic control, along with removal of such temporary structures, traffic control, and surfacing, at the end of the suspension at no additional cost to the City. Before
suspension, the Contractor shall protect slopes without vegetation in accordance with Section 01563 Erosion Control and Storm Water Management.

If during a suspension the Contractor fails to accommodate traffic or maintain the project, including temporary traffic control devices, the Engineer may direct other organizations to do so. The City shall deduct the cost from monies due the Contractor or bill the Contractor, as appropriate.

During suspensions, the Contractor shall complete necessary measures to protect the work and the roadway during the suspension. The Contractor shall repair or replace materials lost or damaged during the suspension at no additional cost to the City.

The Contractor shall resume work when conditions are favorable or when approved by the Engineer.

7.08 Extension of Contract Completion Date. The contract time for completion shall be fixed by the City and stated in the Contract Agreement, either as a calendar date or as a specified number of calendar days.

The Contractor shall perform the work in an acceptable manner within the time stated in the contract except that the contract time for completion may be adjusted as follows:

1. If the satisfactory completion of the contract shall require performance of work in greater quantities than those set forth in the proposal, the time allowed for performance shall be increased in the same ratio as the final estimate bears to the original contract amount, except that the final monetary amount of any contract modification for which an extension of contract time was previously allowed shall be deducted from the final estimate prior to making the pro-rata time adjustment.

2. If delays beyond the Contractor’s control are caused solely by action or inaction by the City, or are for unforeseen causes beyond the control and without fault or negligence of the Contractor, such delays will entitle the Contractor to an extension of time which will be based upon the effect of delays to the project as a whole and will not be granted for non-controlling delays to minor included portions of work, unless it can be shown that such delays did, in fact, delay the progress of the project as a whole. Written request for such extension of time must be made by the Contractor within ten (10) calendar days after the beginning of such delay.

No allowance shall be made for delay or suspension of the work due to fault of the Contractor. Nor will the City grant an extension based on pleas that the contract specified insufficient time for completion of the project.

7.09 Concurrent Delays. Concurrent delays are delays occurring at the same time to separate critical activities. When concurrent delays occur, the City will use only the
longer delay, and/or the excusable delay, to determine extensions to the contract completion date. Non-excusable delays will not be considered for extensions.

7.10 Weather Days. The Adverse Weather Table shows the number of working days included in the contract time in anticipation of weather that may preclude work. If the Contractor believes that it is entitled to additional time for adverse weather, the Contractor must submit written documentation to the Engineer and City within five (5) working days of the end of month that adverse weather was experienced. The Engineer may extend the completion date if the actual number of adverse weather days exceeds the expected number and the Contractor has pursued the work diligently during the month. The determination as to whether a day is to be considered an adverse weather day shall be at the discretion of the Engineer for when work on critical path items cannot be accomplished. The Engineer shall not count or treat Sundays or holidays as adverse weather days. Any weather days not used during any month are invalid and cannot be considered cumulative. For partial months, the Engineer shall prorate the number of expected lost workdays due to adverse weather.

ADVERSE WEATHER TABLE

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<th>MONTH</th>
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8.00 MEASUREMENT AND PAYMENT

8.01 Measurement of Quantities. The Engineer shall measure pay items in the units of measure specified in the contract using methods of measurement and computation that meet generally recognized good engineering practice. The Engineer shall measure pay items when in place and complete. The actual work performed shall be measured, excluding work outside the construction limits unless adjusted by the City. The Engineer shall measure pay item quantities using the following methods, unless otherwise provided elsewhere in the contract documents:

1. Area. Computed from linear distances measured horizontally. Individual fixtures occupying areas equal to or less than 9 sq. ft. shall not be deducted from the computation.

2. Linear. Items measured by the foot shall be measured parallel to the surface on which the items are installed.

3. Lump Sum. Although actual quantities of the components in a lump sum pay item used in the work may differ from the estimated quantities specified, the City will not change the amount of payment.
4. Volumes of Excavation, Embankment, and Similar Pay Items. The average end area method shall be used unless otherwise specified or agreed to.

5. Asphalt Materials. Measured by the gallon or short ton, subject to correction for foaming, shipping loss, or other reasons for nonuse.

6. Delivery Tickets. All delivery tickets that are required for the purpose of calculating quantities for payment must be received by the Engineer at the time of delivery. Payment shall not be made for delivery tickets which do not show type of material, gross weight, tare weight, truck number, and date. Delivery tickets shall utilize automatic printer systems. Scale certification shall be submitted before their use. In no case shall materials weighed on non-certified scales be accepted for payment.

8.02 Compensation for Altered Quantities. Unless otherwise provided, payments to the Contractor shall be made for the actual quantities of contract items performed in accordance with the plans and specifications, and if, upon completion of the construction, these actual quantities show either an increase or decrease from quantities given in the bid schedule, the contract unit prices shall still prevail. Except as provided otherwise, the City shall not allow for increased expense, loss of expected reimbursement, or loss of anticipated profits suffered or claimed by the Contractor from any cause, including directly from alterations or indirectly from unbalanced allocation by the bidder of overhead expense among the pay items.

8.03 Monthly Progress Payment. The City shall make payments at least once each month in accordance with Article 4. Compensation and Method of Payment of the Contract Agreement as work progresses. The Contractor shall supply supporting billing documentation, including as a minimum, a spreadsheet (form to be approved by the Engineer) which lists each item of work included in the Bid Proposal form and shows quantities and amounts currently being invoiced and previously invoiced. Payments shall be based on the Engineer’s approval of the estimate of the value of work performed and materials complete-in-place, in accordance with the contract, and for materials delivered, in accordance with item 8.04 Payment for Material on Hand below.

8.04 Payment for Material on Hand. The City may pay for materials stockpiled or stored for later use on the project and for which the Contractor provides acceptable documentation indicating the materials meet contract requirements. Stockpiled or stored materials may be located on the project or at facilities approved by the City, which the City reserves the right to inspect. Materials shall be stored in accordance with manufacturer’s recommendations. The City shall not make such payment without a written request received at least ten (10) calendar days before the date of the next scheduled progress payment, and in no case will it pay more than fifty (50) percent of the item’s original bid extension. The Contractor shall include with the written request documentation, such as copies of invoices, freight bills, or other information required by the Engineer, that supports material and shipping costs.
9.00 MOBILIZATION

Payment shall be made for mobilization to cover the costs of preparatory work and operations including but not limited to those necessary for the movement of personnel, equipment, supplies and incidentals to the project site; for the establishment of all field offices, storage buildings, and other facilities necessary for the work on the project, and for all other work and operations which must be performed, or costs incurred, prior to beginning work on the various items on the project.

Mobilization shall be measured on a lump sum basis and payment shall be made with the monthly estimate based on the percentage of the original contract amount earned in accordance with the following:

1. On the first estimate following award, 10 percent of the Mobilization pay item or 1 percent of the original contract amount, whichever is less will be paid.

2. When 5 percent of the original contract amount is earned, 25 percent of the amount bid for Mobilization or 2 percent of the original contract amount, whichever is less will be paid.

3. When 10 percent of the original contract amount is earned, 50 percent of the amount bid for Mobilization or 5 percent of the original contract amount, whichever is less will be paid.

4. When 25 percent of the original contract amount is earned, 60 percent of the amount bid for Mobilization or 6 percent of the original contract amount, whichever is less will be paid.

5. When 50 percent of the original contract amount is earned, 70 percent of the amount bid for Mobilization or 7 percent of the original contract amount, whichever is less will be paid.

6. When 70 percent of the original contract amount is earned, 100 percent of the amount bid for Mobilization or 10 percent of the original contract amount, whichever is less will be paid.

7. Upon completion of all work on the project, payment on any amount bid for Mobilization in excess of 10 percent of the original contract amount will be paid.

The total sum of all payments will not exceed the original contract amount bid for Mobilization, regardless of the fact that the contractor may have shut down work on the project or moved equipment away from the project and then back again.

Mobilization is subject to the retainage that shall be withheld for final payment.
The payment schedule for mobilization shall be utilized for construction staking, contractor materials testing, and similar items, when the method of measurement and basis of payment is not otherwise specified in the contract documents.