

**U.S. DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT**

**REFERENCED OSDF SPECIFICATIONS
(Part of 20105-TS-0001)**

02100	Surveying
02200	Earthwork
02215	Trenching and Backfilling
02230	Road Construction
02270	Surface Water Management and Erosion Control
02714	Geotextiles
02930	Vegetation

SECTION 02100**SURVEYING****PART 1 GENERAL****1.01 SCOPE**

- A. This Section includes the requirements for surveying. Requirements include, but shall not be limited to:
1. establishing permanent and temporary survey benchmarks and control points;
 2. establishing a horizontal and vertical project control system based on existing benchmarks;
 3. setting limits and boundaries of construction activities;
 4. performing support surveys and surveys for conformance checks, "red-line" drawings, and sketches, and to determine measurement of quantities for periodic progress payments and final payment;
 5. preparing and furnishing "red-line" drawings and sketches; and
 6. surveys for Excavation Project.

1.02 RELATED SECTIONS AND PLANS

- A. Section 02110 - Clearing, Grubbing, and Stripping
- B. Section 02200 - Earthwork
- C. Section 02205 - Impacted Material Excavation
- D. Section 02206 - Earthwork for Remediation
- E. Section 02207 - Area Isolation Trenching
- F. Section 02215 - Trenching and Backfilling
- G. Section 02225 - Compacted Clay Liner and Cap
- H. Section 02230 - Road Construction
- I. Section 02240 - Non-Impacted Protective and Contouring Layers
- J. Section 02250 - Vegetative Soil Layer
- K. Section 02270 - Surface-Water Management and Erosion Control

- L. Section 02271 - Riprap
- M. Section 02275 - Surface Water Management and Erosion Control for Remediation
- N. Section 02280 - Biointrusion Barrier
- O. Section 02605 - High-Density Polyethylene (HDPE) Pipes and Fittings
- P. Section 02710 - Granular Drainage Material
- Q. Section 02712 - Granular Filter Material
- R. Section 02721 - Culverts
- S. Section 02770 - Geomembrane Liner and Cap
- T. Section 02831 - Chain-Link Fences and Gates
- U. Section 02920 - Topsoil
- V. Section 13000 - Borrow Area Management
- W. Section 13005 - Liner Penetration Boxes
- X. Section 13010 - Impacted Materials Placement
- Y. Impacted Materials Placement (IMP) Plan
- Z. Fluor Fernald Traveler Package
- AA. Construction Quality Assurance (CQA) Plan
- BB. Soil Disposal Facility Project Integrated Health and Safety Plan, Document Number 20100-HS-002

1.03 REFERENCES

- A. National Geodetic Survey (NGS) Standards.

1.04 QUALIFICATIONS

- A. Oversight for the survey work shall be provided and certified by a Land Surveyor licensed in the State of Ohio.

- B. Surveying work shall be performed under the direct supervision of a person who has at least 5 years of experience in construction surveying.
- C. Work performed in referencing or re-establishment of land or United States survey monuments shall be signed and sealed by a Land Surveyor licensed in the State of Ohio.

1.05 SUBMITTALS

- A. Submit a copy of Land Surveyor's license and a résumé of the person supervising the surveys to the Construction Manager within 10 calendar days from Notice to Proceed.
- B. For each liner and cap submit two copies of proposed control points on a minimum 50-foot grid for verification of the following surfaces at least 3 days prior to commencement of work:
 - 1. subgrade for roads, clay liner, and for other locations shown on the construction drawings;
 - 2. top of compacted clay liner;
 - 3. top of protective clay layer in Area 1;
 - 4. top of contouring layer;
 - 5. top of compacted clay cap;
 - 6. top of protective clay layer in Area 4; and
 - 7. top of topsoil layer.
- C. Submit electronic files and two hard copies of the survey notes, sketches, and drawings for the following surveys to the Construction Manager within one week of performance:
 - 1. preliminary surveys;
 - 2. intermediate surveys;
 - 3. written statement and surveys for conformance checks and "red-line" drawings;
 - 4. surveys prior to end of construction season and/or winter shutdown;
 - 5. survey at completion of impacted material excavation specified in Section 02205 of the following:
 - a. above Waste Acceptance Criteria (WAC) material;
 - b. above Final Remedial Level (FRL) material;
 - c. Resource Conservation and Recovery Act (RCRA) hazardous waste;
 - d. underground storage tanks and/or associated soil; and
 - e. Hazardous Waste Management Units (HWMUs);

6. survey at completion of the Contract;
 7. measurement and payment surveys; and
 8. final surveys.
- D. On request by the Construction Manager, submit documentation verifying accuracy of survey work.
- E. Upon completion of the survey work, provide the Construction Manager the original field notes, layout, computations, signed and sealed sketches and drawings in Microstation V.8 ".dgn" format or electronic files in other format approved by the Construction Manager.
- F. One complete set of final "red-line" drawings, sketches, and survey notes signed and sealed by a Land Surveyor licensed in the State of Ohio shall be submitted to the Construction Manager within 15 days of completion of the Contract. Drawing and sketch format shall be Microstation V.8 ".dgn" or electronic files in other format approved by the Construction Manager. Survey notes shall include a point listing with coordinates, elevation, and description.

1.06 PROJECT RECORD DOCUMENTS

- A. Maintain on site, a complete, accurate log documenting survey work as it progresses.
- B. Maintain on-site, a plan showing survey control points, and benchmarks with coordinates and elevations.
- C. Maintain on-site, an accurate and current set of marked-up "red-line" drawings showing "as-built" conditions. "As-built" conditions shall be marked-up on "red-line" drawings within two (2) weeks of completion of the respective construction activity.

1.07 HEALTH AND SAFETY REQUIREMENTS

- A. Environmental health & safety/training requirements shall be in accordance with Contract Documents, Soil Disposal Facility Project Integrated Health and Safety Plan, and Fluor Fernald Traveler Package.

1.08 CONTRACTOR'S QUALITY ASSURANCE

- A. Contractor's quality assurance requirements shall be in accordance with Contract Documents, the CQA Plan, and this Section.

PART 2 PRODUCTS

2.01 MATERIALS AND SURVEY INSTRUMENTS

- A. Provide materials as required to properly perform the surveys, including, but not limited to, personal protective equipment, instruments, tapes, rods, measures, mounts and tripods, stakes and hubs, nails, ribbons, other reference markers, and all else as required.
- B. The survey instruments used for this work shall be precise and accurate to meet the needs of the project. Survey instruments shall be capable of reading to a precision of 0.001 feet and with a setting accuracy of ± 8 seconds.

PART 3 EXECUTION

3.01 GENERAL

- A. Maintain accurate and complete notes of surveys:
 - 1. Handwritten survey field notes and information shall be documented. A copy of the numbered, dated, and signed documentation shall be given to the Construction Manager weekly or upon request by the Construction Manager. Survey notes shall be legibly recorded. Notation shall be consistently applied to survey work. The stake marking format and the document notations shall be compatible. Identify survey benchmarks on the field notes, sketches, and drawings.
 - 2. Electronically collected field survey information shall be stored, for retrieval and submittal if requested by the Construction Manager, during the period of performance of the Contract.
 - a. Electronic format for printed output of data collector field survey notes shall be compatible with the approved field notation format.
 - b. Electronic format for printed output of data collector survey work shall be compatible with the Contractor's computer equipment and software specified in this Section for verifying and checking the work. A copy of the data disk shall be submitted to the Construction Manager monthly.
 - 3. Submit electronic file and two hard copies of above information when requested by the Construction Manager
- B. During construction, survey notes shall be retained by the Contractor and Land Surveyor.
- C. Perform surveys for conformance checks specified in this Section. Contractor shall submit a written statement with conformance surveys certifying compliance of the preceding layer thickness, limits, and grades to the Construction Manager.

- D. The precision of horizontal and vertical controls shall meet or exceed Third-Order Class I and Third-Order accuracies, respectively, as defined by NGS Standards.
- E. Conformance check surveys for elevation and for horizontal coordinates shall be recorded to the nearest 0.01 feet and for angles shall be to the nearest 20 seconds.
- F. Measurement and payment surveys for elevation and for horizontal distances shall be recorded to the nearest 0.1 feet and 0.05 feet, respectively.
- G. Final "red-line" drawings and sketches shall be signed and sealed for method and accuracy of work by the Land Surveyor.
- H. Perform construction layout surveys in advance of scheduled construction activities. At completion of a survey, provide a copy of the field notes, drawings, or sketches to the Construction Manager for review. The Contractor shall allow the CQC Consultant and/or Construction Manager three working days for review of conformance surveys. The Contractor shall be responsible for rework and/or construction delays caused by survey or staking errors.
- I. Set grade and slope stakes required for construction activities as the work progresses. Staking shall be in accordance with accepted surveying practices, provisions herein, and subject to Construction Manager review. Set fine grade stakes on all surfaces for which the plans show a definite grade line. Grade stakes shall not be permitted on soil layers overlying any geosynthetic material within 12 inches of the geosynthetic material or on the contouring layer and first lift of compacted clay cap.
- J. Verify pipe alignment and elevation. The Contractor shall:
 - 1. check layout and elevation of pipe embedment fill prior to pipe placement;
 - 2. check pipe alignment during placement and backfill; and
 - 3. verify alignment and elevation at top of pipe after pipe has been backfilled to top of pipe at a maximum interval of 25 feet.
- K. Upon completion of the work, the Contractor shall provide the Construction Manager with original survey field notes, layouts, computations, and electronic files, binders containing electronic file information and one copy each of electronic files specified in this Section.
- L. Protect benchmarks and survey control points. Replace disturbed survey control points and benchmarks at no additional cost.
- M. Establish temporary survey control points to support construction work activities.

- N. Survey control points, accuracy, and documentation:
 - 1. Record the following information in survey notebooks for each control point established:
 - a. designation of control point;
 - b. coordinates based on State Planar North American Datum (NAD) 1983 Ohio South;
 - c. elevations based on National Geodetic Vertical Datum (NGVD);
 - d. date of establishment;
 - e. description and sketch of the control point location; and
 - f. control points referenced to a minimum of three features that can be seen from the control point.
 - 2. Document survey work in the fieldbooks using the format and procedures described below:
 - a. title and consecutive fieldbook number on the front cover;
 - b. consecutively numbered pages;
 - c. table of contents, indicated by survey task, on the first numbered page;
 - d. legend indicating symbols used in survey notes;
 - e. names of survey team for each task;
 - f. notes on weather, equipment, etc.;
 - g. date and time on each page to indicate when work was recorded;
 - h. notes in a uniform character such that they can be interpreted and used by anyone with survey knowledge; and
 - i. description and/or sketches of the existing survey control used.

- O. Provide hardware and software to download data to Fluor Fernald computers as approved by Engineering Manager.

3.02 SUPPORT SURVEYS

- A. Preliminary Surveys:
 - 1. Verification of the Existing Conditions:
 - a. Prior to the start of clearing and earthwork activities, verify the accuracy of the existing conditions shown on the Construction Drawings and Reference Drawings. Immediately notify the Construction Manager in writing of deviations from the existing conditions indicated on the Construction Drawings and Reference Drawings that affect construction cost and/or schedule.
 - 2. Verify the existing benchmarks, structures, utilities, wells, topography, surface-water management and erosion control measures, construction safety and radiological-control fences, sedimentation basins and appurtenances, drainage features, and existing stockpiles of materials and quantities shown on the Construction Drawings, Reference Drawings, or specified in the Contract. Notify

the Construction Manager of any differences or conflicts with work included in this Contract.

3. Verify Mid-Valley Pipeline Easement as shown on the Construction Drawings adjacent to battery limits. Stake western limits of easement at 50-foot intervals.
4. Establish construction limits required for installation of the construction safety fence and radiological-control fence specified in Section 02200.
5. Establish location for the installation of the surface-water management and erosion control measures specified in Sections 02270, 02271, and 02275.
6. Clearing Limit Staking: Stake clearing limits specified in Section 02110.
7. Alignment and Existing Ground Staking: Following clearing operations and before stripping operations begin, preliminary locations of alignments and/or baseline of project features shall be established. Perform topographic surveys to describe original ground features before stripping or excavation begins. The distance between grid points shall not exceed 50 feet, and all breaks shall be noted.
8. Earthwork Staking: Staking for excavation and fill limits shall establish the exterior limits of excavations and fills. The maximum staking interval shall be 50 feet. Stakes shall be prominently noted with description of point, vertical distance to design elevation, and offset distance as applicable.
9. Perform additional surveys required for the layout of other construction activities.
10. Prior to construction activities in remedial excavation areas specified in Sections 02205 and 02207, perform topographic surveys of above-WAC and impacted runoff catchment area (IRCA) stockpiles, staging areas, excavation areas, and concrete crushing support areas at minimum 50-foot intervals with additional points as follows:
 - a. grade breaks;
 - b. points of horizontal curvature and tangency;
 - c. edge and corners of concrete or asphalt pads, slabs, catch basins, and manholes;
 - d. above-grade obstructions (e.g., fire hydrants, utility poles, handrails, etc.); and
 - e. ditches, channels, and depressions.In addition, spot check slab elevations as indicated on applicable building foundation reference drawings. This includes basement, pit, sump, and other below-grade slab elevations.
11. Prior to area isolation trench excavation specified in Section 02207, survey the trench location and stake the centerline of the trenches.
12. Initial limits of excavation specified in Section 02207 shall be surveyed and staked after the completion of excavation of area isolation trenches.
13. The centerline of the completed area isolation trench specified in Section 02207 shall be surveyed with reference to the permanent trench monuments and staked after the completion of trenching. Provide redline mark-ups showing where the

trench deviates from the design location by more than the maximum lateral tolerance specified in Section 02207. The Contractor will identify the area isolation trench using a rope boundary. The rope will be a color other than orange, yellow, or magenta.

B. Intermediate Surveys:

1. Perform surveys during progress of the construction activities to verify the accuracy of work and as directed by the Construction Manager. These surveys include, but are not limited to, surveys of the subgrade excavation; compacted clay liner and cap; LDS, LCS, and cover drainage layers; protective layer; contouring layer; biointrusion barrier layer; granular filter; vegetative soil layer; topsoil; LDS and LCS piping; horizontal monitoring wells; select impacted material layer; impacted material layer; and other surveys directed by the Construction Manager.
2. Perform surveys for the impacted material placement and stockpiles as follows:
 - a. Survey the locations and surface of impacted material placement when the category of impacted material changes in any given grid. Survey the locations and surface of the previous layers prior to changing impacted material category within the grid.
 - b. Survey the locations and surface of completed impacted material lifts in any grid where placement occurs at or near the end of the workday.
 - c. Survey the impacted material placed in the OSDF every week and within one working day of the last day of the month. This survey shall include locations, elevations, category of impacted materials, and pertinent information in ASCII format necessary to develop a 3-D topographic computer generated surface.
 - d. Perform interim surveys of impacted material stockpiles or other areas designated by the Construction Manager. This survey shall include volume (CY) remaining in the stockpiles or in designated areas.
 - e. Survey the impacted material surface in the OSDF, including the cell access ramps, at the completion of the construction season activities.
3. Perform surveys for measurement and periodic progress payment as specified in this Section.
4. Perform surveys during progress of impacted material excavations specified in Section 02205 to confirm limits of the excavation.
5. Perform survey if either the unsaturated sands and gravel of the Great Miami Aquifer (GMA) are encountered or excavation has reached the GMA elevation as indicated on the Construction Drawings.
6. Perform surveys after the installation of the first 2 feet of GMA plug placement to confirm 2 feet thickness.
7. Perform surveys upon restoration of the minimum 5-foot protective cover over the unsaturated sands and gravel of the GMA.

8. Perform surveys when establishing new Special Material Transfer Areas.
9. Prior to obtaining GMA plug material as specified in Section 02206, perform topographic survey and establish work limits of designated borrow areas.
10. Perform survey at the completion of each supplemental excavation.

C. Final Surveys:

1. Final topography shall be surveyed at nominal 50-foot intervals. Additionally, the following points shall be surveyed as applicable:
 - a. grade breaks;
 - b. points of horizontal curvature and tangency; and
 - c. points of stationing equation.
2. Structures: Survey structure centerlines or building lines so that the orientation, position, limits, and foundation elevation(s) are positively identified.
3. Ditches and Channels: Survey ditches, channels, and culverts as specified in Sections 02270, 02275, and 02721.
4. Limits of Final Excavations: Survey limits of final impacted material excavations.
5. Pipes: Utility pipes shall be surveyed at nominal 25-foot intervals at the top of pipe. Surface-water management pipes shall be surveyed at inlet and outlet inverts and along perimeter of riprap protection.

3.03 SURVEYS FOR MEASUREMENT AND PAYMENT

- A. Perform surveys for periodic progress payments and final payment to determine quantities of work and percent of completed work. Quantities to be measured and measurements for quantities shall be as specified in Part 6 of the Contract Documents.
- B. Calculate and certify quantities of work and submit survey notes and calculations to the Construction Manager for review, evaluation, and payment.

3.04 SURVEYS FOR CONFORMANCE CHECKS AND "RED-LINE" DOCUMENTS

- A. Survey the following to verify the locations, lines, and grades achieved during construction for conformance checks and "red-line" documents:
 1. for berms, roads, ditches, and other earthwork specified in Sections 02200, 02206, 02230, and 02270:
 - a. original grade surface;
 - b. compacted surface of cut slopes; and
 - c. finished grade surface;
 2. for culverts and other surface-water management and erosion control structures specified in Sections 02270 and 02721:
 - a. original grade surface;
 - b. pipe inverts; and

- c. finished grade surface including riprap protection at inverts;
3. for the subgrade specified in Section 02200:
 - a. prepared subgrade surface;
4. for the trenching and backfilling specified in Section 02215:
 - a. bottom of the liner system anchor trench and pipe trench and top of finished compacted backfill; and
 - b. pipes and culverts;
5. for the compacted clay liner specified in Section 02225:
 - a. finished compacted clay liner surface;
6. for the liner penetration boxes specified in Section 13005 and shown on the Construction Drawings:
 - a. original grade surface; and
 - b. top of liner penetration boxes;
7. for the LDS, LCS, and cover drainage layers, and piping specified in Sections 02605 and 02710:
 - a. finished grade surface;
 - b. horizontal monitoring wells; and
 - c. piping system, including location of each joint;
8. for the granular filter specified in Section 02712:
 - a. finished granular filter surface;
9. for the compacted clay cap specified in Section 02225:
 - a. prepared top of non-impacted contouring layer surface; and
 - b. finished compacted clay cap surface;
10. for the geomembrane liner specified in Section 02770:
 - a. anchor trench;
 - b. top and bottom of side slopes;
 - c. seam intersections;
 - d. repairs; and
 - e. location of destructive testing;
11. for the non-impacted protective layer specified in Section 02240:
 - a. finished protective layer surface;
12. for impacted material placement surface specified in Section 13010:
 - a. top of protective layer surface;
 - b. top of select impacted material layers (liner and final cover system) surfaces;
 - c. top of final impacted material surface (prior to placement of select impacted material layer in final cover system); and
 - d. Category 5 material placement per specialized placement plans as specified in the IMP Plan.
13. for biointrusion barrier specified in Section 02280:
 - a. finished biointrusion barrier surface;

14. for topsoil specified in Section 02920;
 - a. top of topsoil surface;
 15. for chain-link fences and gates specified in Section 02831:
 - a. location and alignment;
 16. for the borrow area specified in Section 13000;
 - a. test pits used for pre-conformance testing; and
 - b. finished grades of interim restoration of borrow subareas;
 17. centerlines at nominal 50-foot intervals and at points of intersection of area isolation trenches specified in Section 02207.
- B. Drawings and sketches for the items described in this Section shall include the following:
1. North arrow, graphical scale, title block, and legend;
 2. Northing and Easting grid lines;
 3. spot grade location and elevation on plan including list of coordinates with point number, northing, easting, and elevation in table format;
 4. 1-foot contour lines;
 5. location of structures;
 6. labeled components;
 7. for geomembrane liner and cap plans:
 - a. all seams;
 - b. panel identification numbers;
 - c. location of top of slope, toe of slope, anchor trench, and limits of geomembrane;
 - d. repair location and identifying number; and
 - e. destructive testing location and identifying number.
 8. for pipe profiles:
 - a. original grades with stationing;
 - b. final grades with stationing; and
 - c. pipe with inverts, slopes, pipe material, pipe size, and length of pipe.
- C. Perform conformance checks and "red-line" surveying immediately upon completion of a given installation or excavation activity to facilitate progress and avoid delaying commencement of the next installation. Provide the following minimum spacings and locations for survey points (additional survey points may be required if field conditions warrant):
1. surfaces with gradients less than 10 percent, survey on a square grid spaced not wider than 50 feet;
 2. on slopes greater than 10 percent, a square grid spaced not wider than 50 feet shall be used, but in any case, a line at the crest and toe of the slope shall be taken; if the slope distance is greater than 50 feet, a midpoint slope survey point is required;

3. a line of survey points spaced not more than 50 feet apart shall be taken along any slope break (this will include the inside edge and outside edge of any bench on a slope);
4. a line of survey points spaced not more than 25 feet apart shall be taken at the top of any pipes or other appurtenances; and
5. at the corners and midpoints of the top and bottom of slope breaks for liner penetration areas in cells.

[END OF SECTION]

SECTION 02200**EARTHWORK****PART 1 GENERAL****1.01 SCOPE**

- A. This Section includes site preparation including construction safety fence and radiological-control fence, surface-water management and erosion control, excavation, dewatering, stockpiling, subgrade and top of contouring layer preparation, compacted fill, and clayey rockfill.

1.02 RELATED SECTIONS AND PLANS

- A. Section 02100 - Surveying
- B. Section 02110 - Clearing, Grubbing, and Stripping
- C. Section 02150 - Traffic Control
- D. Section 02205 - Impacted Material Excavation
- E. Section 02206 - Earthwork for Remediation
- F. Section 02215 - Trenching and Backfilling
- G. Section 02225 - Compacted Clay Liner and Cap
- H. Section 02230 - Road Construction
- I. Section 02240 - Non-Impacted Protective and Contouring Layers
- J. Section 02250 - Vegetative Soil Layer
- K. Section 02270 - Surface-Water Management and Erosion Control
- L. Section 02271 - Riprap
- M. Section 02280 - Biointrusion Barrier
- N. Section 02605 - High-Density Polyethylene (HDPE) Pipes and Fittings
- O. Section 02710 - Granular Drainage Material

- P. Section 02712 - Granular Filter Material
- Q. Section 02714 - Geotextiles
- R. Section 02721 - Culverts
- S. Section 02831 - Chain-Link Fences and Gates
- T. Section 02920 - Topsoil
- U. Section 02930 - Vegetation
- V. Section 13000 - Borrow Area Management
- W. Section 13005 - Liner Penetration Boxes
- X. Section 13010 - Impacted Materials Placement
- Y. Construction Quality Assurance (CQA) Plan
- Z. Fluor Fernald Traveler Package
- AA. Soil Disposal Facility Project Integrated Health and Safety Plan, Document Number 20100-HS-002

1.03 REFERENCES

- A. Latest version of American Society for Testing and Materials (ASTM) Standards:
 - 1. ASTM D 698. Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - 2. ASTM D 2487. Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- B. Reference Reports addressing On-Site Disposal Facility (OSDF) and borrow area site subsurface conditions:
 - 1. "Geotechnical Investigation Report, On-Site Disposal Facility" [Parsons, 1995]. This report contains geotechnical data for the subsurface soils in the OSDF area.
 - 2. "Disposal Facility Pre-Design Geotechnical Investigation, Soil Investigation Data Report, CERCLA-RCRA Unit 2" [Science Applications International Corporation, 1995]. This report presents geotechnical data for the subsurface soils in the OSDF area.

3. "Geotechnical Data and Evaluation Report for East and South Field Borrow Areas" [Parsons, 1996]. This report contains geotechnical data for the subsurface soils in the borrow area.

1.04 SUBMITTALS

- A. Submit to the Construction Manager for review a Contractor's Earthwork Work Plan within 30 calendar days from Notice to Proceed. The Contractor's Earthwork Work Plan shall include, at a minimum:
 1. list of equipment and description of construction methods proposed for the scope specified in this Section and in Sections 02110, 02206, 02215, 02225, 02230, 02240, 02250, 02271, 02280, 02605, 02710, 02712, 02714, 02721, 02831, 02920, 02930, 02940, and 13005;
 2. location of equipment service area and fueling station;
 3. excavation and trenching dewatering methods and techniques;
 4. methods for removal of visible rock particles larger than specified from the material for compacted fill and clayey rockfill specified in this Section and compacted clay liner and cap specified in Section 02225;
 5. coordination of survey requirements for the site work;
 6. verification of the existing conditions and material stockpiles;
 7. stockpile management plan including surface-water management and erosion control, stockpiling by type of material, stockpile maintenance, stockpile removal and relocation, and site grading and stabilization;
 8. coordination of earthwork activities with Contractor's Surface-Water Management and Erosion Control Work Plan specified in Section 02270;
 9. schedule for site work activities;
 10. water supply system including location, type, and size of water tank, water distribution system and equipment for dust control, construction and wheel wash system;
 11. plan and measures for cold weather at temperatures below 32 degrees Fahrenheit site work activities;
 12. installation and maintenance of construction safety fence and radiological-control fence;
 13. coordination with Traffic Control Plan specified in Section 02150;
 14. location of construction laydown area(s);
 15. locations of stockpiles for material generated from clearing, grubbing, and stripping operations;
 16. layout and typical cross sections of roads within the Contractor's work area;
 17. construction site access and haul road layout;
 18. construction utilities layout including construction power and water;
 19. description of methods for installation and removal of trench supports; and

20. coordination with the Contractor's Quality Assurance Work Plan in accordance with Fluor Fernald Traveler Package.

1.05 HEALTH AND SAFETY REQUIREMENTS

- A. Environmental health & safety/training requirements shall be in accordance with Contract Documents, Soil Disposal Facility Project Integrated Health and Safety Plan, and Fluor Fernald Traveler Package.

1.06 CONTRACTOR'S QUALITY ASSURANCE

- A. Contractor's quality assurance requirements shall be in accordance with Contract Documents, the CQA Plan, and this Section.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Obtain fill material for compacted fill from OSDF cell excavation, trenching, and stockpiles approved by the Construction Manager. Obtain additional fill material for compacted fill, if required, from the on-site borrow area indicated on the Construction Drawings. Borrow area management shall be in accordance with Section 13000.
- B. Fill material for compacted fill and trench backfill shall be free of debris, foreign objects, large rock fragments, organics, and other deleterious materials. Visible rock particles shall be maximum dimension of 5 inches for 8-inch \pm 1-inch thick loose lifts and 2 inches for 4-inch \pm 1-inch thick loose lifts. Material for compacted fill shall conform to GC, SC, SM, ML, CL, or CH according to the Unified Soil Classification System (per ASTM D 2487).
- C. Clayey rockfill: The reject material from clay screening operations may be substituted for material for compacted fill below base aggregate elevations in the impacted material haul roads, cell access ramps, access corridor located outside the perimeter berm baseline, and borrow area haul road; for interim restoration in borrow area; and other fill areas outside the OSDF perimeter berm baseline. Use of clayey rockfill as specified in this Section shall be approved by the Construction Manager.
- D. Construction water for moisture conditioning compacted fill shall be obtained from the on-site water source shown on the Construction Drawings.
- E. Construction safety fence and radiological-control fence for activities with duration less than 30 calendar days shall be orange, high-density polyethylene, 4 feet in height,

opening size approximately 4 inches by 1 inch, minimum tensile strength of 2000 pounds per foot of width or galvanized steel welded wire fabric as specified in this Section. Where used to delineate radiologically controlled areas (RCAs), no fencing is required. Contractor shall install posts and Fluor Fernald will provide and install yellow/magenta rope. Posts shall be T-shaped (T-post), 1-1/2 inch by 1-1/2 inch, 3/16 inch thick by 5 feet long (minimum), and made of steel or as approved by the Construction Manager.

- F. Furnish construction safety fence and radiological-control fence for activities with a duration greater than 30 calendar days made of galvanized steel welded wire fabric, 2 inch by 4 inch mesh, 4 feet in height, 12-1/2 gauge, or equivalent approved by the Construction Manager. Posts for the fence material shall be 6 feet long and made of steel. Install posts at spacing recommended by the Manufacturer's installation procedures and as required to prevent sagging.
- G. Contractor shall furnish and install signs for construction safety fence in accordance with Part 8 of the Contract Documents.
- H. Signs for radiological-control fence shall be furnished and installed by Fluor Fernald, Inc.

2.02 EQUIPMENT

- A. Furnish equipment to perform work specified in this Section.
- B. Furnish equipment to achieve required compaction specified in this Section.
- C. Furnish hand compaction equipment, such as walk-behind padfoot compactors, hand tampers, or vibratory plate compactors, for compaction in areas inaccessible to large compaction equipment.
- D. Furnish water tank trucks (water wagons), pressure distributors, or other equipment designed to apply water uniformly and in controlled quantities at variable surface widths to provide the required in-place moisture content and to prevent drying of soil surfaces.
- E. Furnish equipment such as scarifiers, disks, spring tooth or spike tooth harrows, earth hauling equipment, and other equipment as required for earthwork construction.

PART 3 EXECUTION**3.01 GENERAL**

- A. Verify existing conditions in accordance with Section 02100.
- B. Perform construction activities in such a manner that equipment operating in the RCAs do not operate in non-RCAs. Equipment operating in RCAs shall be washed by the Contractor; and radiologically surveyed and released by Fluor Fernald, Inc. prior to exiting for use in non-RCAs.
- C. Install surface-water management and erosion controls in accordance with Section 02270.
- D. Dust control shall be in accordance with Fluor Fernald Traveler Package.

3.02 SITE PREPARATION

- A. Install construction safety fence and radiological-control fence at construction limits and limits of the RCAs in accordance with the Contractor's Earthwork Work Plan and Part 8 of the Contract Documents. Relocate construction safety fence and radiological-control fence as shown on the Construction Drawings or as approved by the Construction Manager. Provide construction safety fence as shown on Construction Drawings. Signs and barricades around trenches, stockpiles, and excavated areas shall be in accordance with Fluor Fernald Traveler Package.
- B. Maintain and repair construction safety fence and radiological-control fence for the duration of the Contract. Fencing shall be maintained so as to minimize vertical sagging.
- C. Install, maintain, and inspect surface-water management and erosion controls in accordance with Section 02270.
- D. Prior to earthwork activities, perform clearing, grubbing, and stripping in accordance with Section 02110.
- E. Construct impacted material haul roads, cell access ramps, and access corridors in accordance with the Construction Drawings and Section 02230.
- F. Locate existing manholes, drop inlet structures, monitoring wells, piezometers, lysimeters, utilities, and other subsurface structures in the work area. Protect structures and utilities during earthwork activities as indicated on the Construction Drawings and approved by the Construction Manager.

3.03 SURFACE-WATER MANAGEMENT AND EROSION CONTROL

- A. Install surface-water management and erosion controls in and around work areas in accordance with Section 02270.

3.04 EXCAVATION

- A. Excavate designated areas to the subgrade elevations or excavation limits shown on the Construction Drawings. Stockpile excavated material in the designated stockpile area shown on the Construction Drawings or at locations approved by the Construction Manager.
- B. Excavate material within the excavation limits, including rock encountered, regardless of type, character, composition, and condition. Remove clay pipe tile subdrain system when encountered in accordance with Section 02205. Place clay pipe subdrain section in the OSDF constructed cells in accordance with Section 13010.
- C. Blasting, including use of explosives or explosive devices, shall not be permitted.
- D. Remove and relocate impacted material encountered during excavation in accordance with Section 02205. Impacted material meeting OSDF Waste Acceptance Criteria (WAC) shall be placed in accordance with Section 13010. Impacted materials exceeding OSDF WAC shall be disposed of in accordance with Section 02205.
- E. Minimize sloughing and caving of excavations. Over-excavate and fill areas of excavations that cave or slough with compacted fill in accordance with this Section.
- F. Over-excavate abandoned monitoring wells, borings, utilities, and lysimeters within the OSDF perimeter baseline shown on the Reference Drawings to a depth of 3 feet below subgrade elevation. Well casings, concrete, and grout shall be excavated in accordance with Section 02205 and placed in the OSDF constructed cells in accordance with Section 13010. Before removal of the existing well casings, Construction Managers will verify closure of the existing wells. Fill to subgrade elevation with compacted fill in accordance with this Section.
- G. Do not remove soil from the site or dispose of soil included in this Contract except as approved in writing by the Construction Manager.
- H. Perform activities in such a manner that hauling equipment transporting non-impacted materials do not operate on roads used to haul impacted material. Equipment driven on roads used to haul impacted material or in an impacted area shall be washed by Contractor, and radiologically surveyed and released by Fluor Fernald, Inc. prior to being used for earthwork activities in non-impacted areas.

- I. Perform activities in such a manner that earthwork and hauling equipment working in contamination areas do not cross into certified areas.
- J. Remove the existing Rerouted North Entrance and North Entrance Road pavement within the limits shown on the Construction Drawings and haul and place in OSDF constructed cells in accordance with Section 13010. Existing North Entrance Road pavement section consists of 6 inches of asphaltic concrete over 6 inches of crushed rock. Existing rerouted North Entrance Road pavement section consists of 12 inches of asphalt concrete over 8 inches of crushed rock. Existing rerouted North Entrance Road pavement section consists of 12 inches of asphaltic concrete over 8 inches of crushed rock. Excavate 2 feet below bottom of pavement elevation and road shoulder in accordance with Section 02205 and place in accordance with Section 13010, unless otherwise directed by the Construction Manager.
- K. Stabilize disturbed areas in accordance with Section 02930.

3.05 EXCAVATION DEWATERING

- A. Anticipate seepage of groundwater into and accumulation of surface-water runoff in excavations. Manage groundwater and surface-water runoff in excavations in accordance with this Section and Section 02270.
- B. Collect water that accumulates in the excavation in a toe drain, or other suitable sump, and pump to the former production area stormwater drain control system, the leachate transmission system, or other locations as directed by the Construction Manager.
- C. Prevent surface-water runoff from adjacent areas from entering the excavation in accordance with Section 02270.

3.06 STOCKPILING

- A. Stockpile excavated soils in the stockpile areas shown on the Construction Drawings or as directed by the Construction Manager.
- B. Construct stockpiles no steeper than 3H:1V (horizontal:vertical) unless otherwise approved by the Construction Manager. Grade stockpiles to drain, seal by tracking perpendicular to the slope contours with a dozer, and dress stockpiles daily during periods when material is taken from or added to the stockpile.
- C. Install surface-water management and erosion control measures at the stockpile areas in accordance with Section 02270. Stabilize stockpiles in accordance with Section 02930.

3.07 SUBGRADE AND TOP OF CONTOURING LAYER PREPARATION

- A. Subgrade and top of contouring layer material shall be free of debris, foreign objects, organics, and other deleterious materials.
- B. In the event saturated subgrade is encountered, localized sumps shall be constructed to facilitate removal of water. Manage removed water in accordance with this Section.
- C. Perform subgrade and top of contouring layer proofrolling by driving a loaded dump truck with minimum loaded weight of 20 tons and minimum weight of 10 tons per axle or other pneumatic-tired vehicle back and forth across the area to be prepared to confirm the firmness of subgrade and top of contouring layer surface. Overlap the passes such that one set of tires on each pass runs between the two sets of tire tracks from the previous pass. Soils shall not exhibit pumping or develop ruts more than 2 inches in depth. Rutting, larger than 2 inches, shall be scarified in accordance with this Section and regraded with compacted fill material or non-impacted contouring layer material to meet the proposed subgrade or top of contouring layer elevations.
- D. Subgrade for the compacted clay liner and top of contouring layer shall be scarified in accordance with Section 02225. At other locations where compacted fill is to be placed, prepare the subgrade by scarifying to a depth of 2 inches using the equipment identified in this Section.
- E. In areas where unsuitable soils are encountered, remove and replace the soil to a minimum depth of 1 foot below the proposed subgrade elevation. Remove unsuitable subgrade to an additional depth if necessary to obtain a suitable soil surface for subsequent fill placement. Removal of unsuitable soils to additional depth shall be as approved by the Construction Manager. Suitable soil surface exhibiting pumping or developing ruts more than 2 inches in depth shall be removed to a minimum depth of 1 foot or dried in place by a method approved by the Construction Manager. Fill areas from which subgrade has been removed with compacted fill in accordance with this Section. Compact the fill material to at least 95 percent standard Proctor maximum dry unit weight as determined by ASTM D 698. Compact the uppermost lift of compacted fill beneath road and access corridor alignments to a minimum 98 percent of the standard Proctor maximum dry unit weight as determined by ASTM D 698.
- F. In excavations or other areas where water accumulates, implement measures to remove the water in accordance with this Section. Maintain the subgrade surface free of standing water and in a firm condition to meet the proofrolling requirements of this Section. Maintain dewatered areas in this condition until overlying construction is complete.
- G. Manage surface-water runoff or runoff in accordance with Section 02270.

3.08 COMPACTED FILL

- A. Use fill material that meets the material requirements of this Section. Place the fill material to the limits and grades shown on the Construction Drawings.
- B. Place fill material on surfaces which are free of debris, branches, vegetation, mud, ice, or other deleterious materials.
- C. Place fill material in loose lifts with a thickness of 8 inches \pm 1 inch. In areas where compaction is to be performed using hand-operated equipment, place the fill material in loose lifts with a thickness of 4 inches \pm 1 inch.
- D. Remove visible rock particles with a maximum dimension larger than 5 inches for 8-inch \pm 1-inch thick loose lifts. For 4-inch \pm 1-inch thick loose lifts, the maximum rock particle size shall be 2 inches.
- E. Prior to placing a succeeding lift of fill material over a previously compacted lift, thoroughly scarify the previous lift to a depth of 2 inches by discing, raking, or tracking with a dozer. Moisture condition the preceding lift in accordance with this Section if the moisture content of the surface of the preceding lift is not within the range of acceptable moisture contents specified in this Section.
- F. The trafficking of scarified surfaces by trucks or other equipment, except compaction equipment, is not permitted.
- G. The maximum acceptable soil clod size after processing is 3 inches. Reduce clod size by discing, raking, tracking with a dozer, using a soil stabilizer, or other means approved by the Construction Manager. Soil clumps, consisting of an agglomeration of 3-inch clods, or smaller, will not be considered a clod for purposes of this Section.
- H. Compact fill material in each lift to at least 95 percent of its standard Proctor maximum dry unit weight as determined by ASTM D 698. Compact fill at a moisture content within \pm 3 percentage points of the standard Proctor optimum moisture content as determined by ASTM D 698.
- I. Moisture condition the fill material to achieve the compaction requirements of this Section. Use a water spraying system for wetting. During wetting or drying, regularly disc, rake, or otherwise mix the material to thoroughly blend the moisture throughout the lift. Use discing, raking, or other appropriate methods to dry the material as required.
- J. Do not place frozen fill nor place fill material on frozen subgrade or previously placed compacted fill.

- K. Do not compact fill material at temperatures below 32 degrees Fahrenheit, unless authorized in writing by the Construction Manager.
- L. Do not place fill during periods of precipitation. Placement may occur during periods of misting or drizzle, but only if authorized by the Construction Manager.
- M. Rework compacted fill that does not meet the required compaction.

3.09 CLAYEY ROCKFILL

- A. Visible rock particles with maximum dimension greater than 12 inches shall be removed from the clayey rockfill and stockpiled for future use in areas designated by the Construction Manager. Clayey rockfill shall be placed in maximum 12-inch thick loose lifts and compacted with a minimum of four passes of a Caterpillar 815 compactor or approved equal. Final lift surface of compacted clayey rockfill material shall be proofrolled as specified in this Section. Any compacted clayey rockfill material exhibiting excessive pumping or rutting (ruts greater than 2 inches in depth) due to wet material or insufficient compaction shall be dried and recompacted or removed from the fill. Clayey rockfill shall be used only as specified in this Section unless otherwise approved by the Construction Manager.

3.10 PERFORATIONS

- A. Perforations in the compacted fill, subgrade, and top of contouring layer resulting from survey stakes or other activities shall be backfilled with soil or bentonite mix specified in Section 02225. Perforations resulting from nuclear density tests and sand-cone or drive cylinder density tests will be filled by the CQC Consultant in accordance with Section 02225.

3.11 CONSTRUCTION QUALITY REQUIREMENTS

- A. CQC Consultant will perform soil conformance testing on compacted fill materials to confirm compliance with this Section. Conformance testing to be performed and minimum testing frequencies shall be in accordance with the Construction Quality Assurance (CQA) Plan. Provide equipment and labor to assist the CQC Consultant in obtaining conformance samples from excavations, stockpiles, and borrow areas. Identify source(s) and quantity of fill material required from each source for Construction Manager's approval at least 15 calendar days prior to use.
- B. CQC Consultant will monitor earthwork activities in accordance with this Section and the CQA Plan. CQC Consultant will provide documentation to the Construction Manager for the proofrolling of subgrade, top of contouring layer, and compacted clayey rockfill final lift surface.

- C. CQC Consultant will perform performance testing on compacted fill lifts to confirm compliance with this Section. The performance testing to be performed and minimum testing frequencies shall be in accordance with the CQA Plan.
- D. If CQC Consultant's tests indicate that any portion of the compacted fill does not meet the requirements of this Section, CQC Consultant will delineate the extent of the nonconforming area. Rework the nonconforming area until it meets the requirements of this Section.

3.12 SURVEY CONTROL

- A. Survey the locations, limits and grades of excavations, stockpiles, prepared subgrade, compacted fill, and compacted clayey rockfill in accordance with Section 02100.

3.13 TOLERANCES

- A. Perform the earthwork construction to within ± 0.3 feet of the grades indicated on the Construction Drawings except for subgrade for the compacted clay liner, top of contouring layer, access corridor, and roads for which earthwork construction shall be within -0.3 to $+0.1$ feet of the grades indicated.

[END OF SECTION]

SECTION 02215**TRENCHING AND BACKFILLING****PART 1 GENERAL****1.01 SCOPE**

- A. This Section includes trenching and backfilling, including pipe embedment fill materials and placement.

1.02 RELATED SECTIONS AND PLANS

- A. Section 02100 - Surveying
- B. Section 02110 - Clearing, Grubbing, and Stripping
- C. Section 02200 - Earthwork
- D. Section 02225 - Compacted Clay Liner and Cap
- E. Section 02605 - High-Density Polyethylene (HDPE) Pipes and Fittings
- F. Section 02721 - Culverts
- G. Section 13000 - Borrow Area Management
- H. Construction Quality Assurance (CQA) Plan
- I. Fluor Fernald Traveler Package
- J. Soil Disposal Facility Project Integrated Health and Safety Plan, Document Number 20100-HS-002

1.03 REFERENCES

- A. Latest version of American Society for Testing and Materials (ASTM) Standards:
 - 1. ASTM C 136. Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - 2. ASTM D 698. Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).

- B. Latest version of Ohio Department of Transportation Construction and Material Specifications (Ohio DOT Specifications).
- C. Latest version of Occupational Safety and Health Administration (OSHA) Construction Standards.
- D. Reference Reports addressing On-Site Disposal Facility (OSDF) and borrow area site subsurface conditions and off-site borrow sources:
 - 1. "Geotechnical Investigation Report, On-Site Disposal Facility" [Parsons, 1995]. This report contains geotechnical data for the subsurface soils in the OSDF area.
 - 2. "Disposal Facility Pre-Design Geotechnical Investigation, Soil Investigation Data Report, CERCLA-RCRA Unit 2" [Science Applications International Corporation, 1995]. This report presents geotechnical data for the subsurface soils in the OSDF area.
 - 3. "Geotechnical Data and Evaluation Report for East and South Field Borrow Areas" [Parsons, 1996]. This report contains geotechnical data for the subsurface soils in the borrow area.
 - 4. "Off-Site Borrow Materials Geotechnical Evaluation Report" [Parsons, 1996]. This report presents geotechnical data for potential off-site borrow sources for OSDF construction materials, including fine concrete aggregates (sand), coarse concrete aggregates (gravel), pea gravel, and riprap.

1.04 SUBMITTALS

- A. For each source of pipe embedment fill material, submit the following to the Construction Manager for review within 30 calendar days from Notice to Proceed:
 - 1. the source of the pipe embedment fill material;
 - 2. written certification and test results conducted in accordance with ASTM C 136; and
 - 3. a 50-pound representative sample of the pipe embedment fill for visual examination, and testing, if necessary.
- B. Provide a list of equipment, description of construction methods for trenching and backfilling, and other required information for trenching and backfilling in the Contractor's Earthwork Work Plan specified in Section 02200.

1.05 HEALTH AND SAFETY REQUIREMENTS

- A. Environmental health and safety/training requirements shall be in accordance Contract Documents, Soil Disposal Facility Project Integrated Health and Safety Plan, and Fluor Fernald Traveler Package.

1.06 CONTRACTOR'S QUALITY ASSURANCE

- A. Contractor's quality assurance requirements shall be in accordance with Contract Documents, the CQA Plan, and this Section.

PART 2 PRODUCTS**2.01 MATERIALS**

- A. Furnish natural sand pipe embedment fill material for reinforced concrete pipe (RCP), corrugated metal pipe (CMP), and high-density polyethylene (HDPE) pipe meeting the gradation requirements of Section 703.06 of the Ohio DOT Specifications unless otherwise indicated on the Construction Drawings or specified in this Section. Gradation testing shall be in accordance with ASTM C 136.
- B. Furnish trench backfill material for RCP, CMP, HDPE pipe, and electrical conduit that meet the fill material requirements for compacted fill specified in Section 02200. Obtain trench backfill material from OSDF cell excavation, trenching, and stockpiles shown on the Construction Drawings. Obtain additional material for trench backfill, if required, from on-site borrow areas indicated on the Construction Drawings. Borrow area management shall be in accordance with Section 13000.
- C. Trench backfill material for liner system anchor trenches shall meet the material requirements for compacted clay liner and cap specified in Section 02225.
- D. Construction water for moisture conditioning trench backfill shall be obtained from on-site water source shown on the Construction Drawings.
- E. Furnish a minimum 4-inch wide plastic underground marker tape with suitable warning legend to mark HDPE pipes and electrical conduits.
- F. Furnish 14-gauge insulated stranded copper wire marker tape as shown on the Construction Drawings.
- G. Bentonite for soil-bentonite plugs shall be in accordance with Section 02225.

2.02 EQUIPMENT

- A. Furnish equipment to perform the work specified in this Section.
- B. Furnish hand compaction equipment such as walk-behind pad-foot compactor, hand tamper, or vibratory plate compactors for compaction in areas inaccessible to large compaction equipment.

PART 3 EXECUTION**3.01 GENERAL**

- A. Verify existing conditions in accordance with Section 02100.
- B. Review existing site utility drawings, and identify and stake existing above and below ground utilities in vicinity of trenching. Staking shall be as approved by the Construction Manager.
- C. In areas of trenching and backfilling, maintain and protect existing above and below ground utilities.
- D. Do not damage or disturb survey benchmarks, finished construction, and existing utilities and structures.
- E. Perform clearing, grubbing, and stripping in accordance with Section 02110.
- F. Dust control for trenching and backfilling shall be in accordance with Contract Documents and Fluor Fernald Traveler Package.

3.02 TRENCHING

- A. Trench for placement of pipes and for liner system anchor trenches shall be to the depths and dimensions shown on the Construction Drawings. Stockpile excess excavated material from trenching in the stockpile areas shown on the Construction Drawings or as approved by Construction Manager in accordance with Section 02200.
- B. Use trench support methods approved by the Construction Manager. Trench support shall satisfy applicable local, state, and federal requirements, including requirements of the OSHA Construction Standards. Provide trench support materials on site prior to the start of trenching. Maintain the safety and stability of slopes and trenches and protect adjacent utilities and structures.
- C. Protect and maintain the trench bottom. Remove rock fragments or raveled materials that collect on the trench bottom. Backfill any overexcavation with compacted fill in accordance with Section 02200. Excavate any soft subgrade encountered at the trench bottom and backfill to trench bottom elevation with compacted fill in accordance with Section 02200.
- D. Where trenches will be excavated in compacted fill areas, perform trenching only after compacted fill has reached at least 12 inches above proposed elevation of top of the pipe.

- E. For pipe installation limit the maximum length of open trench to 200 feet in advance and 200 feet behind pipe unless otherwise approved by the Construction Manager. For anchor trench limit, open trenches to length of proposed daily geosynthetics installation unless otherwise approved by the Construction Manager. Contractor shall provide appropriate non-skid surface walkways, such as wooden boards, for access across open trenches.
- F. Continuously dewater trenches. Perform dewatering in accordance with Section 02200.
- G. The inside edge of liner system anchor trenches where geosynthetics will be placed shall be trenched to minimize soil raveling and shall be rounded to a minimum 6-inch radius.

3.03 BACKFILLING

- A. General:
 - 1. Do not backfill with frozen or saturated material.
 - 2. Do not backfill over frozen, wet, or soft trench bottom or side slopes. Remove materials that are frozen, wet, or soft as specified in this Section.
 - 3. Do not disturb or damage piping or geosynthetics in trench during backfilling.
 - 4. Do not use compaction equipment which exerts greater than 10 pounds per square inch ground pressure over piping that is covered by less than 12 inches of backfill material.
- B. Placement of pipe embedment fill for pipes and culverts:
 - 1. Place pipe embedment fill in 7-inch \pm 1-inch thick loose lifts to the elevation of the bottom of the pipe or culvert.
 - 2. Compact pipe embedment fill with a minimum of 4 passes of a vibratory plate compactor prior to placing pipe.
 - 3. Place pipe or culvert on top of the compacted pipe embedment fill.
 - 4. Install 14-gauge insulated stranded copper wire to top of HDPE pipes as shown on the Construction Drawings. Use cable tie-wraps at 5-foot intervals to tie copper wire to pipe prior to backfilling.
 - 5. For pipes 12 inches in diameter or less, place additional pipe embedment fill on the sides and gently hand tamp the fill around the sides as needed, such that intimate contact between the pipe and the pipe embedment fill is maintained below the spring line of the pipe. Continue placing pipe embedment fill until it is even with the top of the pipe. Compact the pipe embedment fill with a minimum of 4 passes of a walk-behind pad-foot compactor, hand tamper, or vibratory plate compactor, as appropriate. Place pipe embedment fill above the top of pipe to a minimum depth of 12 inches in two 7-inch \pm 1-inch thick loose lifts. Compact each lift of pipe

embedment fill with a minimum of 4 passes of a walk-behind pad-foot compactor, hand tamper, or vibratory plate compactor, as appropriate.

6. For pipes or culverts greater than 12 inches in diameter, place pipe embedment fill in 7-inch \pm 1-inch thick loose lifts to the limits shown on the Construction Drawings. Compact each lift with a minimum of 4 passes of a vibratory plate compactor.
7. For horizontal monitoring well pipe trenches and HDPE pipe trenches between each valve house tie-in and the cell outlet, construct a soil-bentonite plug every 50-feet along the length of the trench. Prepare soil-bentonite mixture consisting of embedment fill at its natural moisture content mixed with minimum 10 percent (by dry weight basis) bentonite granules. Thoroughly mix with a portable cement mixer or other method as approved by the Construction Manager. Place and compact the soil-bentonite mixture in the same manner as specified in this Section for the embedment fill.

C. Placement of trench backfill material for pipes and culverts:

1. After placement and compaction of pipe embedment fill to the limits shown on the Construction Drawings, place the first lift of trench backfill material in a 12-inch thick loose lift. Place subsequent lifts of trench backfill material in 8-inch \pm 1-inch thick loose lifts.
2. Compact trench backfill material in each lift to at least 95 percent of its standard Proctor maximum dry unit weight and at a moisture content within \pm 3 percent of the optimum moisture content as determined by ASTM D 698.

D. Placement of trench backfill material for liner system anchor trench:

1. Place the anchor trench backfill material in 8-inch \pm 1-inch thick loose lifts if compaction equipment operating weight is greater than 2000 pounds, and in 4-inch \pm 1-inch thick loose lifts if compaction equipment operating weight is less than 2000 pounds.
2. Compact the anchor trench backfill material to the minimum dry unit weight and range of moisture contents required for compacted clay liner and cap material specified in Section 02225.

- E. Place underground marker tape in trench backfill 12 inches below finished grade above underground pipes and electrical conduits as shown as the Construction Drawings.

3.04 PERFORATIONS

- A. Perforations in the trench backfill resulting from survey stakes or other activities shall be backfilled with trench backfill material. Perforations resulting from nuclear density

tests and sand-cone or drive cylinder density tests will be filled with trench backfill material by the CQC Consultant.

3.05 CONSTRUCTION QUALITY REQUIREMENTS

- A. CQC Consultant will perform conformance testing on pipe embedment fill and trench backfill materials to establish compliance with this Section, and Sections 02200 and 02225, as applicable. The conformance testing to be performed and the minimum testing frequencies shall be in accordance with the Construction Quality Assurance (CQA) Plan.
- B. CQC Consultant will monitor trenching and backfilling as specified in this Section and the CQA Plan.
- C. CQC Consultant will perform performance testing on the backfill materials to establish compliance with this Section. The performance testing to be performed and minimum testing frequencies shall be in accordance with the CQA Plan.
- D. CQC Consultant shall review and approve pipe installation as-built elevations prior to backfilling.

3.06 SURVEY CONTROL

- A. Survey the locations, limits, and grades of the bottom of the liner system anchor trench and compacted trench backfill in accordance with Section 02100.
- B. Survey the locations, limits, and grades of pipes and culverts, including invert elevations, in accordance with Section 02100.

3.07 TOLERANCES

- A. Trench bottom shall be within 0.0 to +0.2 feet of the depth indicated on the Construction Drawings.
- B. Embedment fill for pipes and culverts shall be placed within 0.0 to +0.2 feet of the depth indicated on the Construction Drawings.

[END OF SECTION]

SECTION 02230**ROAD CONSTRUCTION****PART 1 GENERAL****1.01 SCOPE**

- A. This Section includes impacted material haul roads, cell access ramps, access corridor, the Emergency Access Road, the Special Materials Transfer Area (SMTA), and other roads and areas as shown on the Construction Drawings to be surfaced with base aggregate.

1.02 RELATED SECTIONS AND PLANS

- A. Section 02100 - Surveying
- B. Section 02110 - Clearing, Grubbing, and Stripping
- C. Section 02150 - Traffic Control
- D. Section 02200 - Earthwork
- E. Section 02270 - Surface-Water Management and Erosion Control
- F. Section 02714 - Geotextiles
- G. Construction Quality Assurance (CQA) Plan
- H. Fluor Fernald Traveler Package
- I. Soil Disposal Facility Project Integrated Health and Safety Plan, Document Number 20100-HS-002

1.03 REFERENCE

- A. Latest version of Ohio Department of Transportation Construction and Material Specifications (Ohio DOT Specifications).

1.04 SUBMITTALS

- A. For each source of base aggregate material, submit the following to the Construction Manager for review within 30 calendar days from Notice to Proceed:
 - 1. the source of the materials along with written certification from the supplier that the material meets the material requirements of this Section; and
 - 2. certification shall include test results as required by Ohio DOT Specifications for base aggregate materials demonstrating that it meets the requirements of items from the Ohio DOT Specifications specified in this Section.
- B. Provide a list of equipment, description of construction methods, and other required information to perform the construction activities described in this Section with the Contractor's Earthwork Work Plan specified in Section 02200.

1.05 HEALTH AND SAFETY REQUIREMENTS

- A. Environmental health & safety/training requirements shall be in accordance with Contract Documents, Soil Disposal Facility Project Integrated Health and Safety Plan, and Fluor Fernald Traveler Package.

1.06 CONTRACTOR'S QUALITY ASSURANCE

- A. Contractor's quality assurance requirements shall be in accordance with Contract Documents, the CQA Plan, and this Section.

PART 2 PRODUCTS**2.01 MATERIALS**

- A. Furnish base aggregate material consisting of crushed carbonate stone or crushed gravel, free of organic matter and other deleterious materials, which meets the requirements of Items 304.02 and 703.04 (2) of the Ohio DOT Specifications for aggregate base.
- B. Furnish a geotextile separator meeting the requirements of Section 02714.
- C. Furnish materials for compacted fill or clayey rockfill meeting the requirements of Section 02200.
- D. Furnish road signs and other traffic controls in accordance with Section 02150.

2.02 EQUIPMENT

- A. Furnish equipment for construction of impacted material haul roads, cell access ramps, access corridors, the Emergency Access Road, the SMTA, and other roads shown on the Construction Drawings in accordance with the requirements of this Section.

PART 3 EXECUTION

3.01 GENERAL

- A. Dust control during the performance of road construction activities described in this Section shall be in accordance with Contract Documents and Fluor Fernald Traveler Package.
- B. Install surface-water management and erosion controls in accordance with Section 02270.
- C. Perform clearing, grubbing, and stripping to the limits indicated on the Construction Drawings or identified by the Construction Manager, and in accordance with Section 02110 prior to any earthwork activity.

3.02 SUBGRADE PREPARATION

- A. Prepare subgrade for the road construction described in this Section in accordance with Section 02200.

3.03 GEOTEXTILE PLACEMENT

- A. Install the geotextile separator over the prepared subgrade in accordance with Section 02714.

3.04 BASE AGGREGATE

- A. Construct the base aggregate layer to the thickness, grades, and limits indicated on the Construction Drawings.
- B. Place the base aggregate material on top of the geotextile separator by end dumping and carefully spread using a track bulldozer. Do not operate equipment directly on the geotextile.
- C. Place the base aggregate in accordance with the requirements of Item 304.04 of the Ohio DOT Specifications.

- D. Compact the base aggregate in accordance with the requirements of Item 304.05 of the Ohio DOT Specifications.

3.05 CONSTRUCTION QUALITY REQUIREMENTS

- A. CQC Consultant will perform conformance testing on materials for compacted fill used for the construction described in this Section to establish compliance with this Section and Section 02200 as applicable. Conformance testing to be performed and minimum testing frequencies shall be in accordance with the Construction Quality Assurance (CQA) Plan.
- B. CQC Consultant will monitor road construction in accordance with this Section and the CQA Plan.
- C. CQC Consultant will perform performance testing on compacted fill and/or compacted clayey rockfill used for the construction described in this Section to establish compliance with this Section and Section 02200. Performance test requirements and minimum testing frequencies shall be in accordance with the CQA Plan.

3.06 SURVEY CONTROL

- A. Survey alignment and grades for roads, ramps, the SMTA, and corridor in accordance with Section 02100.

TOLERANCES

- A. Construct the base aggregate to within 0.0 to +0.1 feet of the thickness indicated on the Construction Drawings.
- B. Construct the impacted material haul roads, cell access ramps, access corridor, the Emergency Access Road, the SMTA, and other roads shown on the Construction Drawings to within ± 0.2 feet of the grades indicated on the Construction Drawings.

[END OF SECTION]

SECTION 02270**SURFACE-WATER MANAGEMENT AND EROSION CONTROL****PART 1 GENERAL****1.01 SCOPE**

- A. This Section includes materials and placement of silt fence, erosion mat, check dams, construction entrances, diversions, ditches, channels, berms, and stabilization; and maintenance of sedimentation basins and surface-water management and erosion control measures.
- B. Surface-water management and erosion control for the impacted material placement shall be in accordance with Section 13010.

1.02 RELATED SECTIONS AND PLANS

- A. Section 02100 - Surveying
- B. Section 02200 - Earthwork
- C. Section 02240 - Non-Impacted Protective and Contouring Layers
- D. Section 02271 - Riprap
- E. Section 02275 - Surface Water Management and Erosion Control For Remediation
- F. Section 02721 - Culverts
- G. Section 02930 - Vegetation
- H. Section 13010 - Impacted Materials Placement
- J. Surface-Water Management and Erosion Control (SWMEC) Plan
- K. Construction Quality Assurance (CQA) Plan
- L. Fluor Fernald Traveler Package
- M. Soil Disposal Facility Project Integrated Health and Safety Plan, Document Number 2001-HS-002

1.03 REFERENCES

- A. Latest version of Ohio Department of Natural Resources (ODNR) Rainwater and Land Development Standards (ODNR Rainwater and Land Development Standards).

1.04 SUBMITTALS

- A. Submit to the Construction Manager for review within 15 calendar days from Notice to Proceed, Contractor's Surface-Water Management and Erosion Control Work Plan that shall be prepared in accordance with this Section, Section 02240, Section 02275, Section 13010, ODNR Rainwater and Land Development Standards, and the Surface-Water Management and Erosion Control (SWMEC) Plan, and shall include but not be limited to the following:
 - 1. descriptions of the surface-water management and erosion control measures to be implemented throughout the duration of the Contract;
 - 2. a list of equipment, description of methods, and other required information for installing and maintaining surface-water management and erosion control measures specified in this Section;
 - 3. drawings showing, in plan view, the location and sequencing of the surface-water management and erosion control measures and other required information for installation of surface-water management and erosion control measures;
 - 4. drawings showing details of the surface-water management and erosion control measures; and
 - 5. calculations supporting the selection and use of surface-water management and erosion control measures.
- B. Submit the following to the Construction Manager for review within 15 calendar days from Notice to Proceed:
 - 1. manufacturer's product data and recommended methods of installation for products used for surface-water management and erosion control measures; and
 - 2. certification from the supplier or Manufacturer that products meet the requirements of this Section.

1.05 HEALTH AND SAFETY REQUIREMENTS

- A. Environmental health & safety/training requirements shall be in accordance with Contract Documents, Soil Disposal Facility Project Integrated Health and Safety Plan, and Fluor Fernald Traveler Package.

1.06 CONTRACTOR'S QUALITY ASSURANCE

- A. Contractor's quality assurance requirements shall be in accordance with Contract Documents, the CQA Plan and this Section.

PART 2 PRODUCTS**2.01 SILT FENCE**

- A. Furnish silt fence with either woven or nonwoven geotextile conforming to ODNR Rainwater and Land Development standards. Silt fence shall:
1. be woven geotextile consisting of slit films of polypropylene treated with ultraviolet light stabilizers, or nonwoven geotextile consisting of long chain polymeric filaments or polyester yarns;
 2. be inert to chemicals commonly found in soils and to hydrocarbons;
 3. be resistant to mildew, rot, insects, and rodent attack; and
 4. have geotextile and fence post properties and minimum dimensions in accordance with this Section and ODNR Rainwater and Land Development Standards.

2.02 EROSION MAT

- A. Furnish erosion mat which shall be a woven blanket-like fabric made of biodegradable yarn with the following material properties:
1. Yarn Content: 100 percent jute except as indicated on Construction Drawings;
 2. Weight: Minimum 11.5 ounces per square yard;
 3. Open Area: 55 ±10 percent; and
 4. Minimum Mesh Opening: 0.5 inches.
- B. Furnish erosion mat having a permissible velocity of 7 feet per second (fps).
- C. Furnish erosion mat that will resist degradation for a minimum 6-month period after installation.
- D. Coir material at locations indicated on the Construction Drawing shall meet or exceed above requirements.

2.03 STABILIZATION

- A. Materials for stabilization, including vegetation and crusting agent, shall be in accordance with Section 02930.

2.04 OTHER MATERIALS

- A. Riprap shall be in accordance with Section 02271.
- B. Culverts shall be in accordance with Section 02721.
- C. Materials for berms shall be as specified for compacted fill in Section 02200.

- D. Construction entrances shall be in accordance with ODNR Rainwater and Land Development Standards.
- E. Diversions and channels shall be in accordance with ODNR Rainwater and Land Development Standards.
- F. Materials for other surface-water management and erosion controls, including storm drain inlet protection, shall be in accordance with ODNR Rainwater and Land Development Standards.

2.05 EQUIPMENT

- A. Furnish equipment to perform work specified in this Section.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Silt Fence
 - 1. Install silt fence in accordance with ODNR Rainwater and Land Development, and at the locations required by the Contractor's Surface-Water Management and Erosion Control Work Plan.
- B. Erosion Mat
 - 1. Provide erosion mat at the locations indicated on the Construction Drawings and the locations indicated on the Contractor's Surface-Water Management and Erosion Control Work Plan, and those locations resulting from Section 02930 permanent slope stabilization requirements. Begin installation of erosion mat in a specific area within 48 hours after seeding has been completed in that area. Seeding shall be as specified in Section 02930. If seeding coverage in an area is lost due to inclement weather prior to installation of the erosion mat, Contractor shall reseed the previously seeded area.
 - 2. Place erosion mat on a prepared surface that is free of deleterious vegetation, trash, ruts, and rocks.
 - 3. Overlap adjacent erosion mats in accordance with the Manufacturer's recommendations.
 - 4. Install and staple erosion mat in accordance with Manufacturer's recommendations, except staples shall be a minimum 6-inches in length.
- C. Install check dams in ditches and channels in accordance with ODNR Rainwater and Land Development Standards.

- D. Apply crusting agents in accordance with Section 02930. Areas of crusting agent application shall be approved in advance by the Construction Manager.
- E. Stabilize and vegetate disturbed areas in accordance with Section 02930.
- F. Install riprap in accordance with Section 02271 and as shown on the Construction Drawings.
- G. Construct channels, ditches, and berms as shown on the Construction Drawings and in accordance with the Contractor's Surface-Water Management and Erosion Control Work Plan. Earthwork for channels, ditches, and berms shall be in accordance with Section 02200.
- H. Install construction entrances in accordance with the Contractor's Surface-Water Management and Erosion Control Work Plan.
- I. Install additional surface-water management and erosion controls in accordance with the Contractor's Surface-Water Management and Erosion Control Work Plan.
- J. Install storm drain inlet protection in accordance with ODNR Rainwater and Land Development Standards.

3.02 ADDITIONAL REQUIREMENTS

- A. Prevent the runoff of polluting substances such as silt, clay, fuels, oils, and contaminated soils into water supplies and surface waters in accordance with the Contractor's Surface-Water Management and Erosion Control Work Plan.
- B. Remove accumulated silt and debris from behind the face of the silt fence when the silt deposits reach approximately one half the height of the fence. Replace silt fence geotextile damaged during maintenance operations. Removed silt and debris shall be placed in the OSDF constructed cells in accordance with Section 13010 or stockpiled in locations approved by the Construction Manager.

3.03 SURVEY CONTROL

- A. Survey permanent locations of surface-water management and erosion control measures in accordance with Section 02100.

3.04 MAINTENANCE

- A. Clean, maintain, repair, and replace surface-water management and erosion controls for the duration of the Contract in accordance with the Contractor's Surface-Water Management and Erosion Control Work Plan.

- B. Maintain erosion control measures and existing sedimentation basins in accordance with Contract Documents and Fluor Fernald Traveler Package.
- C. Sedimentation basins shall be cleaned of silt once per construction season.

3.05 INSPECTIONS

- A. Inspect surface-water management and erosion control measures and sedimentation basins to evaluate their effectiveness and need for maintenance. Any required repairs to the surface-water management and erosion control measures and sedimentation basins shall be initiated upon discovery, but no later than 24 hours after discovery. Inspections shall occur, at a minimum, at the following frequencies:
 - 1. weekly;
 - 2. daily after each rain event exceeding 0.5 inches; and
 - 3. at least daily during prolonged rainfall events.
- B. Records of inspections shall be kept on file on-site by Contractor and shall be submitted monthly to the Construction Manager. The records of inspection shall include the following:
 - 1. summary of the scope of the inspection;
 - 2. name of inspector;
 - 3. inspection date;
 - 4. inspection location;
 - 5. purpose of the inspection (i.e., regular weekly, following a storm, etc.);
 - 6. observations relative to performance of the surface-water management and erosion control measures;
 - 7. any necessary corrective actions; and
 - 8. corrective actions completed and their performance since the previous inspection.

3.06 CONSTRUCTION QUALITY REQUIREMENTS

- A. CQC Consultant will monitor the installation and maintenance of surface-water management and erosion control measures in accordance with this Section and the Construction Quality Assurance (CQA) Plan.

[END OF SECTION]

SECTION 02714**GEOTEXTILES****PART 1 GENERAL****1.01 SCOPE**

- A. This Section includes materials and installation for geotextiles.
- B. Quantity of geotextile materials to be furnished by Fluor Fernald, Inc. will be as specified in Part 6 of the Contract Documents. Additional required geotextile materials, shall be furnished by the Contractor.

1.02 RELATED SECTIONS AND PLANS

- A. Section 02200 - Earthwork
- B. Section 02215 - Trenching and Backfilling
- C. Section 02230 - Road Construction
- D. Section 02271 - Riprap
- E. Construction Quality Assurance (CQA)
- F. Fluor Fernald Traveler Package
- G. Soil Disposal Facility Project Integrated Health and Safety Plan, Document Number 20100-HS-002

1.03 REFERENCES

- A. Latest version of American Society for Testing and Materials (ASTM) Standards:
 - 1. ASTM D 4355. Standard Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-ARC type apparatus).
 - 2. ASTM D 4491 Standard Test Method for Water Permeability of Geotextiles by Permittivity.
 - 3. ASTM D 4533. Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
 - 4. ASTM D 4632. Standard Test Method for Breaking Load and Elongation of Geotextiles (Grab Method).
 - 5. ASTM D 4751. Standard Test Method for Determining Apparent Opening Size of a Geotextile.

6. ASTM D 4833. Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
7. ASTM D 4873. Standard Guide for Identification, Storage, and Handling of Geotextiles.
8. ASTM D 5261. Standard Test Method for Measuring Mass Per Unit Area of Geotextiles.
9. ASTM D 6241. Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile Related Products Using a 50-mm Probe.

B. Federal Standard No. 751a - Stitches, Seams, and Stitching.

1.04 SUBMITTALS

- A. Submit to the Construction Manager a letter of acceptance for the quantity of geotextile materials furnished by Fluor Fernald, Inc. Quantity of geotextile materials stored on site shall be inspected, inventoried, and accepted within 30 calendar days of Notice to Proceed.
- B. For geotextiles furnished by Contractor, submit the following to Construction Manager for review within 30 calendar days from Notice to Proceed:
 1. product name;
 2. geotextile manufacturing capabilities, including:
 - a. daily production capacity available for this Contract; and
 - b. manufacturing quality control procedures;
 3. certification of minimum average roll values 95 percent lower confidence limits and the corresponding test procedures for all geotextile properties listed in Tables 02714-1 to 02714-5;
 4. Manufacturer's written recommended exposure period after unwrapping the geotextile from their opaque covers;
 5. projected geotextile delivery dates; and
 6. recommended long-term storage requirements and limitations.
- C. For geotextiles furnished by Contractor, submit to Construction Manager for review at least 14 calendar days prior to transporting geotextile to the site, manufacturing quality control certificates signed by the quality control manager applicable to each roll of geotextile as specified in this Section. The submittal shall include a list of roll numbers to be shipped indicating which rolls were sampled and tested. The certificates shall state that the geotextiles are continuously inspected and are needle-free. The quality control certificates shall also include:
 1. lot, roll numbers, and other identification;
 2. sampling procedures; and
 3. results of quality control tests, including descriptions of test methods used (the Manufacturer quality control tests to be performed are specified in this Section).

- D. Provide list of equipment, description of installation methods storage methods in accordance with manufacturer's recommendation, and other required information related to the installation of geotextile in the Earthwork Work Plan specified in Section 02200.

1.05 HEALTH AND SAFETY REQUIREMENTS

- A. Environmental health & safety/training requirements shall be in accordance with Contract Documents, Soil Disposal Facility Project Integrated Health and Safety Plan, and Fluor Fernald Traveler Package.

1.06 CONTRACTOR'S QUALITY ASSURANCE

- A. Contractor's quality assurance requirements shall be in accordance with Contract Documents, the CQA Plan, and this Section.

PART 2 PRODUCTS

2.01 GEOTEXTILE

- A. Geotextile materials furnished by Fluor Fernald, Inc. will meet the following requirements:
 - 1. minimum average roll values with 95 percent lower confidence limits meeting or exceeding the required property values specified in Tables 02714-1 for geotextile filters and sacrificial geotextile filters, 02714-2 for geotextile cushion in final cover system, 02714-3 for geotextile cushion in liner system, 02714-4 for supplemental geotextile cushion in liner and scaraficial geotextile cushion in the final cover systems, and 02714-5 for geotextile separator; and
 - 2. manufactured from first quality polymers, with not more than 20 percent reclaimed polymer used in production.
- B. Geotextiles furnished by Contractor shall meet or exceed the required property values specified in Tables 02714-1 through 02714-5. Geotextiles shall be manufactured from first quality polymers with not more than 20 percent reclaimed polymer used in production.
- C. Furnish polymeric threads for stitching that are ultra-violet (UV) light stabilized to at least the same requirements as the geotextile to be sewn. Threads shall be polyester or polypropylene threads that have a minimum size of 2,000 denier.

2.02 MANUFACTURING QUALITY CONTROL

A. For geotextile furnished by Contractor, sample and test the geotextile to demonstrate that the material conforms to the requirements of this Section. Do not supply any geotextile roll that does not comply with the manufacturing quality control requirements.

1. Perform manufacturing quality control tests to demonstrate that properties conform to the values specified in Tables 02714-1 to 02714-5. Perform the following manufacturing quality control tests at a maximum interval of one test for each 50,000 square feet manufactured. All tested rolls of material used to certify compliance shall be delivered to the site. Test data for rolls not delivered to the site will not be accepted.

<u>Test</u>	<u>Procedure</u>
Mass per unit area	ASTM D 5261
Grab strength	ASTM D 4632
Tear strength	ASTM D 4533
Puncture strength	ASTM D 4833
Static puncture strength	ASTM D 6241

2. Perform additional manufacturing quality control tests on geotextile filter properties only, at a maximum interval of one test for each 100,000 square feet manufactured or minimum one per resin lot used to demonstrate that its apparent opening size (ASTM D 4751) and permittivity (ASTM D 4491) conform to the values specified in Table 02714-1. All tested rolls of material used to certify compliance shall be delivered to the site. Test data for rolls not delivered to the site will not be accepted.

B. For geotextile furnished by Contractor, if a geotextile sample fails to meet the quality control requirements of this Section, sample and test rolls manufactured at the same time and in the same lot as the failing roll. Continue to sample and test the rolls until the extent of the failing rolls are bracketed by passing rolls. Do not supply failing rolls.

2.03 PACKAGING

A. Geotextiles rolls will be wrapped in relatively impermeable and opaque protective covers.

B. Covers which become torn or damaged shall be repaired by the Contractor with similar materials.

- C. Geotextile rolls will be marked or tagged in accordance with ASTM D 4873 with the following information:
 - 1. Manufacturer's name;
 - 2. product identification;
 - 3. lot or batch number;
 - 4. roll number; and
 - 5. roll dimensions.
- D. Geotextile rolls not labeled in accordance with this Section or on which labels are illegible shall be rejected and replaced. The Contractor shall notify the Construction Manager of any rolls not labeled in accordance with the Section.
- E. The minimum size of each lot for geotextile furnished by the Contractor and delivered to the Site will be 100,000 ft².

2.04 SHIPPING

- A. Geotextiles furnished by Contractor, shall not be shipped prior to final review and confirmation of compliance of Manufacturer's quality control submittals specified in this Section and conformance testing specified in the CQA Plan and by the Consultant

2.05 ACCEPTANCE, HANDLING, AND STORAGE

- A. Upon delivery to the project site, Contractor shall inspect and inventory the geotextile materials and the manner in which they are stored. Contractor shall also inspect geotextile material stockpiled at the OSDF. Contractor shall provide to the Construction Manager with a written letter of acceptance within 30 calendar days if material is acceptable for installation. Contractor shall also notify the Construction Manager in writing within 30 calendar days of any geotextile material that is not acceptable for installation.
- B. Protection and preservation of geotextile material shall include, but not be limited to:
 - 1. protection from sunlight, moisture, excessive heat or cold, puncture, mud, dirt, and dust or other damaging conditions; follow geotextile Manufacturer recommendations for handling and storage; Manufacturer recommendations will be provided by the Construction Manager for geotextile furnished by Fluor Fernald, Inc.; and
 - 2. storage of rolls on pallets, or other elevated structures; do not store rolls directly on the ground.
- C. Contractor shall unload, handle and store geotextile material furnished by Fluor Fernald, Inc. and by Contractor. Handling shall be performed such that damage to geotextile materials does not occur.

2.06 EQUIPMENT

- A. Furnish equipment for acceptance, handling, storage, and installation of geotextile.

PART 3 EXECUTION**3.01 PLACEMENT**

- A. Do not commence geotextile installation until the CQC Consultant completes performance testing and confirmation of compliance of underlying layers, including acceptance of Contractor's survey results for underlying layers.
- B. Handle geotextiles so as to ensure they are not damaged.
- C. Take precautions to prevent damage to underlying layers.
- D. After unwrapping the geotextiles from their opaque covers, do not leave them exposed for a period in excess of the Manufacturer's written recommended exposure period.
- E. If white colored geotextiles are used, take appropriate safety precautions against "snowblindness" of personnel.
- F. Take care not to entrap stones, excessive dust, or moisture below or in the geotextiles.
- G. Examine the geotextile surface after installation to ensure that no potentially harmful foreign objects are present. Remove any such objects and replace any damaged geotextiles.

3.02 SEAMS AND OVERLAPS

- A. Continuously overlap a minimum of 6 inches and sew geotextile filters, cushions, and supplemental geotextile cushions using a "single prayer" seam. Sew seams using Stitch Type 401 as per Federal Standard No. 751a. Spot sewing will not be allowed.
- B. Do not install horizontal seams on slopes that are steeper than 10 horizontal to 1 vertical (10H:1V). Seams shall be along, not across, the slopes.
- C. Overlap geotextile separator a minimum of 12 inches and spot sew at intervals to ensure that the overlap is maintained.
- D. Overlap geotextile filter used for riprap construction in Section 02271 a minimum of 12 inches. No seaming is required.

3.03 REPAIR

- A. Repair holes or tears in the geotextiles using a patch made from the same geotextile material. Extend geotextile patches a minimum of 1 foot beyond the damaged area. Sew geotextile patches into place no closer than 1 inch from panel edge. Should tear exceed 50 percent of the width of the panel, cut across the entire width of the panel and seam as an end seam. For slope areas steeper than 10H:1V, tears exceeding 50 percent of the width of the panel shall be removed and replaced.
- B. Remove any soil or other material that may have penetrated the torn geotextiles.

3.04 CREST ANCHORAGE SYSTEM

- A. Install the geotextile along with the other geosynthetic layers in the anchor trench and wedge at the crest of the slope as shown on the Construction Drawings. Temporarily anchor the geosynthetic layers using sandbags or other means until the commencement of trench backfilling. Do not place geotextiles in anchor trench if standing water is present.
- B. Do not entrap soil, sand bags, excessive moisture, or other materials below or between the geosynthetic layers in the anchor trench.
- C. Backfill the anchor trench with compacted clay liner once all the geosynthetic layers are installed in the anchor trench. Backfill to the limits shown on the Construction Drawings. Compact backfill in accordance with Section 02215.
- D. Do not damage exposed geosynthetic layer when backfilling the anchor trench.

3.05 PLACEMENT OF SOIL AND AGGREGATE MATERIALS

- A. Place soil materials on top of geotextiles in such a manner as to ensure that:
 - 1. the geotextiles and the underlying materials are not damaged; and
 - 2. slippage does not occur between the geotextile and the underlying layers during placement.
- B. Spread soil on top of the geotextile to cause the soil to cascade onto the geotextile rather than be shoved across the geotextile.
- C. For geotextile cushions overlying the geomembrane, do not place granular drainage material at ambient temperatures below 40 degrees Fahrenheit (°F) or above 104°F. For placement of granular drainage material below 40°F and above 104°F, Contractor shall submit placement methods to the Construction Manager for review and approval.

- D. Do not drive equipment directly on the geotextile. Only use equipment above a geotextile cushion overlying a geomembrane that meets the following ground pressure requirements:

<u>Maximum Allowable Equipment Ground Pressure (pounds per square inch)</u>	<u>Minimum Thickness of Overlying Fill or Aggregate Layer (inches)</u>
less than 5	12 (see note 1)
less than 10	18
less than 20	24
greater than 20	36

Note 1: Minimum thickness of first loose lift of the clay liner material for the protective clay layer shall be a 10-inch \pm 1-inch.

- E. Place aggregate over geotextile separator as shown on the Construction Drawings prior to trafficking in accordance with Section 02230.
- F. Place soil over geotextile filters as shown on the Construction Drawings prior to trafficking.

3.06 CONSTRUCTION QUALITY REQUIREMENTS

- A. CQC Consultant will perform conformance testing on the geotextile materials furnished by Contractor to establish compliance with this Section. Conformance testing and minimum frequencies shall be in accordance with the Construction Quality Assurance (CQA) Plan.
- B. CQC Consultant will monitor the geotextile installation in accordance with this Section and CQA Plan.

TABLE 02714-1
REQUIRED PROPERTY VALUES FOR GEOTEXTILE FILTER AND
SACRIFICIAL GEOTEXTILE FILTER

PROPERTIES	QUALIFIER	UNITS ⁽⁴⁾	SPECIFIED ⁽³⁾ PROPERTY VALUES	TEST METHOD
<u>Identification Requirements</u>				
Type	(-)	(-)	Nonwoven needlepunched	(-)
Polymer composition	minimum	%	95 polypropylene or polyester by weight	(-)
Mass per unit area	minimum	oz/yd ²	7	ASTM D 5261
<u>Filter Requirements</u>				
Apparent opening size (O ₉₅)	maximum	mm	0.212	ASTM D 4751
Permittivity	minimum	sec ⁻¹	0.5	ASTM D 4491
<u>Mechanical Requirements</u>				
Grab strength	minimum	lb	180	ASTM D 4632 ⁽¹⁾
Trapezoidal tear strength	minimum	lb	75	ASTM D 4533 ⁽²⁾
Puncture strength	minimum	lb	75	ASTM D 4833
Static puncture strength	minimum	lb	450	ASTM D 6241
<u>Durability Requirements</u>				
Ultraviolet Resistance	minimum	%	70	ASTM D 4355

Notes:

- (1) Minimum of values measured in machine and cross machine directions with 1 by 2 inch clamp on Constant Rate of Extension (CRE) machine.
- (2) Minimum value measured in machine and cross machine direction.
- (3) All values represent minimum average roll values.
- (4) mm = millimeter
% = percent
oz/yd² = ounce per square yard
sec = second
lb = pound
psi = pound per square inch

TABLE 02714-2

**REQUIRED PROPERTY VALUES FOR GEOTEXTILE CUSHION
IN FINAL COVER SYSTEM**

PROPERTIES	QUALIFIER	UNITS ⁽⁴⁾	SPECIFIED ⁽³⁾ PROPERTY VALUES	TEST METHOD
<u>Identification Requirements</u>				
Type	(-)	(-)	Nonwoven needlepunched	(-)
Polymer composition	minimum	%	95 polypropylene or polyester by weight	(-)
Mass per unit area	minimum	oz/yd ²	8	ASTM D 5261
<u>Mechanical Requirements</u>				
Grab strength	minimum	lb	200	ASTM D 4632 ⁽¹⁾
Tear strength	minimum	lb	75	ASTM D 4533 ⁽²⁾
Puncture strength	minimum	lb	90	ASTM D 4833
Static puncture strength	minimum	lb	500	ASTM D 6241
<u>Durability Requirements</u>				
Ultraviolet Resistance	minimum	%	70	ASTM D 4355

Notes:

- (1) Minimum of values measured in machine and cross machine directions with 1 by 2 inch clamp on Constant Rate of Extension (CRE) machine.
- (2) Minimum value measured in machine and cross machine direction.
- (3) All values represent minimum average roll values.
- (4) mm = millimeter
% = percent
oz/yd² = ounce per square yard
sec = second
lb = pound
psi = pound per square inch

TABLE 02714-3

**REQUIRED PROPERTY VALUES FOR GEOTEXTILE CUSHION
IN LINER SYSTEM**

PROPERTIES	QUALIFIER	UNITS⁽⁴⁾	SPECIFIED⁽³⁾ PROPERTY VALUES	TEST METHOD
<u>Identification Requirements</u>				
Type	(-)	(-)	Nonwoven needlepunched	(-)
Polymer composition	minimum	%	95 polypropylene or polyester by weight	(-)
Mass per unit area	minimum	oz/yd ²	10	ASTM D 5261
<u>Mechanical Requirements</u>				
Grab strength	minimum	lb	225	ASTM D 4632 ⁽¹⁾
Tear strength	minimum	lb	90	ASTM D 4533 ⁽²⁾
Puncture strength	minimum	lb	120	ASTM D 4833
Static puncture strength	minimum	lb	675	ASTM D 6241
<u>Durability Requirements</u>				
Ultraviolet Resistance	minimum	%	70	ASTM D 4355

Notes:

- (1) Minimum of values measured in machine and cross machine directions with 1 by 2 inch clamp on Constant Rate of Extension (CRE) machine.
- (2) Minimum value measured in machine and cross machine direction.
- (3) All values represent minimum average roll values.
- (4) mm = millimeter
% = percent
oz/yd² = ounce per square yard
sec = second
lb = pound
psi = pound per square inch

TABLE 02714-4

**REQUIRED PROPERTY VALUES FOR SUPPLEMENTAL AND SACRIFICIAL
GEOTEXTILE CUSHION IN LINER SYSTEM
AND FINAL COVER SYSTEM**

PROPERTIES	QUALIFIER	UNITS⁽⁴⁾	SPECIFIED⁽³⁾ PROPERTY VALUES	TEST METHOD
<u>Identification Requirements</u>				
Type	(-)	(-)	Nonwoven needlepunched	(-)
Polymer composition	minimum	%	95 polypropylene or polyester by weight	(-)
Mass per unit area	minimum	oz/yd ²	16	ASTM D 5261
<u>Mechanical Requirements</u>				
Grab strength	minimum	lb	350	ASTM D 4632 ⁽¹⁾
Tear strength	minimum	lb	120	ASTM D 4533 ⁽²⁾
Puncture strength	minimum	lb	180	ASTM D 4833
Static puncture strength	minimum	lb	1,275	ASTM D 6241
<u>Durability Requirements</u>				
Ultraviolet Resistance	minimum	%	70	ASTM D 4355

Notes:

- (1) Minimum of values measured in machine and cross machine directions with 1 by 2 inch clamp on Constant Rate of Extension (CRE) machine.
- (2) Minimum value measured in machine and cross machine direction.
- (3) All values represent minimum average roll values.
- (4) mm = millimeter
% = percent
oz/yd² = ounce per square yard
sec = second
lb = pound
psi = pound per square inch

TABLE 02714-5

REQUIRED PROPERTY VALUES FOR GEOTEXTILE SEPARATOR

PROPERTIES	QUALIFIER	UNITS ⁽⁴⁾	SPECIFIED ⁽³⁾ PROPERTY VALUES	TEST METHOD
<u>Identification Requirements</u>				
Type	(-)	(-)	Nonwoven needlepunched	(-)
Polymer composition	minimum	%	95 polypropylene or polyester by weight	(-)
Mass per unit area	minimum	oz/yd ²	6	ASIM D 5261
<u>Mechanical Requirements</u>				
Grab strength	minimum	lb	180	ASTM D 4632 ⁽¹⁾
Tear strength	minimum	lb	75	ASTM D 4533 ⁽²⁾
Puncture strength	minimum	lb	75	ASTM D 4833
Static puncture strength	minimum	lb	450	ASTM D 6241
<u>Durability Requirements</u>				
Ultraviolet Resistance	minimum	%	70	ASTM D 4355

Notes:

- (1) Minimum of values measured in machine and cross machine directions with 1 by 2 inch clamp on Constant Rate of Extension (CRE) machine.
- (2) Minimum value measured in machine and cross machine direction.
- (3) All values represent minimum average roll values.
- (4) mm = millimeter
% = percent
oz/yd² = ounce per square yard
sec = second
lb = pound
psi = pound per square inch

[END OF SECTION]

SECTION 02930**VEGETATION****PART 1 GENERAL****1.01 SCOPE**

- A. This Section includes soil stabilization, which includes application of crusting agent and establishing vegetation by seeding. The work in this Section includes, but is not limited to; soil preparation, interim vegetation, permanent vegetation, application of fertilizer, application of mulches, and application of crusting agent.

1.02 RELATED SECTIONS AND PLANS

- A. Section 02200 - Earthwork
- B. Section 02270 - Surface-Water Management and Erosion Control
- C. Fluor Fernald Traveler Package
- D. Construction Quality Assurance (CQA) Plan
- E. Soil Disposal Facility Project Integrated Health and Safety Plan, Document Number 20100-HS-002

1.03 REFERENCES

- A. Latest version of Ohio Department of Natural Resources (ODNR) Rainwater and Land Development Standards (ODNR Rainwater and Land Development Standards).
- B. "*Identification and Listing of Hazardous Waste*", Title 40, Code of Federal Regulations (CFR), Part 261, Subpart E.C.
- C. "*Federal Hazardous Material Transportation Law*", U.S. Department of Transportation [U.S. DOT, 1994].

1.04 SUBMITTALS

- A. Submit the following to the Construction Manager for review within 15 calendar days from Notice to Proceed:
 - 1. proposed mixes and application rates for seed, mulch, fertilizers, and crusting agents;

2. Manufacturer's product data and recommended methods of application for seed, mulches, fertilizer, and crusting agents;
 3. product data for fertilizer shall also include chemical analysis including uranium analysis to assure there is no resultant or derived uranium from fertilizer use, unless waived by Construction Manager;
 4. material safety data sheet (MSDS) for fertilizer, mulch binder and crusting agent; and
 5. inoculant information for the permanent seed mixes.
- B. Submit the following to the Construction Manager for review within 30 calendar days before seeding:
1. certificate stating seed mixture, guaranteed percentages of purity, weed content, germination of seed, name of seller, test date for the seed, and the net weight and date of shipment;
 2. Manufacturer's certificate stating the available nutrients contained in the proposed fertilizer;
 3. Manufacturer's certificate stating that the fiber matrix (wood fibers) meets the requirements of this Section;
 4. Manufacturer's certificate stating the mulch binder meets the requirements of this Section;
 5. Manufacturer's certificate stating the crusting agent meets the requirements of this Section; and
 6. documentation of the straw to be used for mulch; this documentation shall verify that the straw is weed free in accordance with the requirements of this Section.
- C. Submit to the Construction Manager for review within 10 calendar days before seeding a plan showing seeding area and a written statement of application rate of seed mix and/or associated materials (i.e., fertilizer, mulch, and mulch binder). Choice of seeding type shall follow the site seeding requirements and as approved by the Construction Manager.
- D. Provide a list of equipment, description of construction methods, and other required information for vegetation and application of crusting agent in the Contractor's Earthwork Work Plan specified in Section 02200.

1.05 HEALTH AND SAFETY REQUIREMENTS

- A. Environmental health & safety/training requirements shall be in accordance with Contract Documents, Soil Disposal Facility Project Integrated Health and Safety Plan and Fluor Fernald Traveler Package.

1.06 CONTRACTOR'S QUALITY ASSURANCE

- A. Contractor's quality assurance requirements shall be in accordance with Contract Documents, the CQA Plan, and this Section.

PART 2 PRODUCTS**2.01 MATERIALS**

- A. Furnish seed labeled in accordance with U.S. Department of Agriculture (USDA) Rules and Regulations under the Federal Seed Act and applicable State seed laws. Furnish seed in sealed bags or containers bearing the date of expiration. Do not use seed after its date of expiration. Each seed mix shall have less than 10 percent weed seed, inert material or other impurities contained in the mix resulting in at least 90 percent by weight live seed. Each seed mix shall have a germination percentage of at least 80 percent by weight for the cover crop species only. Furnish seed mixtures having seed proportioned by weight in accordance with Tables 02930-1A, 02930-1B, 02930-1C and 02930-2. Areas requiring permanent seeding during the summer months (15 June– 20 September), excluding the OSDF Cell Final Cover, shall be seeded with 30 lbs/acre of ReGreen as specified in this Section. An alternative to ReGreen, and the only acceptable alternative for summer seeding of the OSDF Cell Final Cover, is stabilizing with a crusting agent as specified in this Section. Stabilization performed during the summer shall be followed by fall application of the appropriate permanent seed mix.
- B. Permanent seed mixes shall be treated with fungal (Mycorrhizae) inoculant. The specified legumes within the seed mix must be inoculated with the bacterial Rhizobial strains appropriate for the species.
- C. Furnish mulch meeting the following requirements:
1. Mulch shall be straw or wood cellulose fiber, free of clay, stone, foreign substances, and free of weeds.
 2. Straw should not contain sticks larger than ¼-inch diameter or other materials that may prevent matting down during application. Use straw that is free from mold and other objectionable material for placing with mulch blower equipment or other equipment as approved by the Construction Manager. Straw shall be generally 6 inches or more in length.
 3. Straw shall be:
 - a. weed free straw from the Minnesota Crop Improvement Association certified weed free straw vendors;
 - b. straw that has been inspected and determined to be weed free by Central Ohio Seed Testing;

- c. native prairie grass mulch; or
 - d. equivalent substitute as approved by the Construction Manager.
4. Mulch applied by hydrospraying shall be a bonded fiber matrix containing wood fibers held together with a hydrocolloid-based binder, which upon drying becomes insoluble and non-dispersible. Mulch shall be comprised of 39 parts wood fiber to one part binder by weight. The fibers shall be composed of 100 percent wood or wood by-products and shall be 100 percent biodegradable. Use a bonded fiber matrix containing a green dye that will provide for easy visual inspection for uniformity of slurry spread. The bonded fiber matrix, including dye, shall contain no growth or germination inhibiting properties. The wood cellulose fiber shall be manufactured in such a manner that, after addition and agitation in slurry tanks with water, the fibers in the material become uniformly suspended to form a homogeneous material. When sprayed on the ground, the material shall allow absorption and percolation of moisture. The wood cellulose fiber shall meet the following requirements:

<u>Item</u>	<u>Specification Limit</u>
Particle Length	.0.8 inch (maximum)
Particle Thickness	0.047 inch (maximum)
Ph	4.0 to 8.5
Ash Content	1.6% (maximum)
Water Holding Capacity (based on fiber dry weight)	500% (minimum)
Moisture Content	12% ± 4% (by weight)

- D. Mulch binder agent shall be as approved by the Construction Manager and shall meet the following requirements:
1. The mulch binder shall be hydrocolloid base (guar gum) and shall not dissolve or disperse upon rewetting.
 2. The mulch binder shall not have hazardous characteristics of ignitability, corrosivity, reactivity, or toxicity as defined in 40 CFR Part 261, Subpart C, for a hazardous waste in either its pre-applied or cured states.
 3. The mulch binder shall have a flash point greater than 200°F. The mulch binder shall be neither a flammable nor combustible liquid per United States (US) Department of Transportation definition [U. S. DOT, 1994]. The mulch binder must not be susceptible to significant deterioration from exposure to the elements, including sunlight.
 4. The mulch binder shall be provided in concentrated solution and prepared so that it will not change in transportation or storage.

- E. The crusting agent shall be as approved by the Construction Manager and shall meet the following criteria:
1. pine sap emulsion comprised of a 100 percent organic emulsion produced from naturally occurring resins (pine sap); or an approved equal;
 2. not comprised of chloride, lignosulfonate, petroleum, or asphaltic-type emulsions;
 3. provide dust suppression and surface stability for exposed soils, both disturbed and undisturbed soils, and exposed coal fired ash (fly ash);
 4. compatible with application via a hydro seeder, and must not require intense cleaning of equipment after application;
 5. non-tracking (i.e., will not stick to boots or tires) once cured;
 6. not have hazardous characteristics of ignitability, corrosivity, reactivity, or toxicity as defined in 40 CFR Part 261, Subpart C, for a hazardous waste in either its pre-applied or cured states;
 7. have a flash point greater than 200 °F;
 8. be neither a flammable nor combustible liquid per DOT definition; and
 9. not be susceptible to significant deterioration from exposure to the elements, including sunlight.
- F. Erosion mat shall be in accordance with Section 02270.
- G. Fertilizer:
1. Furnish commercial grade fertilizer, uniform in composition that meets the requirements of all State and Federal regulations and standards of the Association of Agricultural Chemists.
 2. Fertilizer shall be slow release complete fertilizer.
 3. Two types of fertilizer mixes shall be used. Fertilizer for application within the former production area shall be 34-0-10; other fertilizers may be approved by the Construction Manager for the former production area, but they must not contain phosphorous. Fertilizer for other areas shall be 22-5-10. Other fertilizers may be approved by the Construction Manager for areas outside the former production area provided the fertilizer mix does not contain more than 6% phosphorous. Fertilizers shall contain not less than 1 percent added sulfur and not more than 8 percent added iron, or an approved equal.
 4. Fertilizer must have MSDS submitted in accordance with this Section.
 5. Fertilizer shall be used for interim seeding only, unless otherwise approved by the Construction Manager.
- H. Construction water shall be obtained from the on-site water source shown on the Construction Drawings.

2.02 EQUIPMENT

- A. Provide equipment of size and type to perform work specified in this Section.

PART 3 EXECUTION**3.01 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver containerized materials in uniform packages bearing the name of the manufacturer, the net weight and a statement of content. Deliver containerized materials to the site in original, properly labeled, unopened, clean containers each showing the manufacturer's guaranteed analysis conforming to applicable regulations and standards.
- B. Store materials in a dry area in a manner to prevent physical damage.

3.02 GENERAL

- A. Stabilization of disturbed areas by vegetation or by use of a crusting agent shall be performed at completion of excavation and stockpiles or within 7 calendar days of knowing a disturbed area will be idle for more than 45 calendar days, whichever is sooner.
- B. Crusting agents may be used as temporary measures prior to placement of interim vegetation after approval for the area by the Construction Manager.
- C. Interim vegetation, as specified in this Section, is required for all areas except OSDF final cover system and soil stockpiles, which are scheduled to be disturbed in future. Interim vegetation shall also be used to establish cover within forest patches planted in Site Restoration Projects. Fertilizer shall be used for interim vegetation as specified in this Section.
- D. Permanent vegetation, as specified in this Section, is required for OSDF final cover system and interim cover system. No fertilizer shall be used with permanent vegetation as specified in this Section.
- E. Disturbed areas which are scheduled to be significantly disturbed after initial stabilization and/or need effective erosion control immediately, are to be stabilized with the interim seed mix rate specified in this Section. Disturbed areas which are not scheduled to be significantly disturbed again are to be stabilized with the permanent seed mix rate specified in this Section. Soil piles, which require effective erosion

control immediately, are to be stabilized with the interim seed mix rate or a crusting agent as specified in this Section.

- F. Use an erosion mat as specified in Section 02270 at locations shown on the Construction Drawings after application of seed mixture.
- G. Area(s) to be seeded shall be generally free of debris, rock, root material, and other objects that may impede soil preparation and seeding activities. Perform soil preparation by tilling/cultivating, to a depth of approximately 2 inches, to eliminate uneven areas and low spots. Maintain lines, levels and contours.
- H. Repeat cultivation in areas where equipment used for hauling and spreading has compacted the area(s) to be seeded.

3.03 APPLICATION

- A. The seeding season, for interim vegetation specified in this Section, is year round. However, if seeding is contemplated during the winter months of December through March, then field conditions should be assessed for ability to provide soil to seed contact. If field conditions do not support the ability to provide soil to seed contact then the area shall be stabilized with a crusting agent followed by seeding during conditions conducive to adequate soil to seed contact.
- B. The permanent seeding in wet and dry areas and the cell final cover shall be performed in the Spring Season between 1 April and 30 June and/or the Fall Season between 15 September and 31 December, unless otherwise approved by the Construction Manager. Seed shall not be applied on frozen ground.
- C. Apply fertilizer, seed, and mulch to disturbed areas and areas excavated and graded under this Contract requiring seeding unless otherwise directed by the Construction Manager. Apply mulch within 24 hours of seeding; do not seed areas in excess of that which can be mulched within 24 hours. Winter application of seed and related materials are subject to adjustment as directed by the Construction Manager.
- D. Apply seed using either the drilling, broadcasting, or hydroseeding method, as described below:
 - 1. Seed drilling method:
 - a. This method shall be used for applying the permanent seed mix in accessible areas unless otherwise approved by the Construction Manager. The method may also be used for interim vegetation.
 - b. Prepare area to be seeded by loosening the soil to a minimum depth of 3 inches.

- c. Apply commercial grade, slow release complete fertilizer, for interim vegetation only, at a rate of 150 lbs/acre at the time of preparing the seedbed for seeding.
 - d. Install seed with a seed drill to obtain a final planting depth of $\frac{1}{4}$ to $\frac{1}{2}$ inch using the seed rates indicated in Tables 02930-1A, 02930-1B, 02930-1C and 02930-2. All seed drilling should be done perpendicular to the direction of surface-water flow.
2. Broadcast Seeding Method:
- a. This method may be used for interim vegetation, and can be performed with the use of mechanical "cyclone" seeders, by hand seeding or by any other method which scatters seed over the soil surface.
 - b. This method may also be used for permanent seeding in areas that are not accessible by the seed drill method or areas where seed drilling cannot be performed perpendicular to the direction of the surface-water flow.
 - c. If Broadcast Method is used to apply permanent seed mix in sloped areas (3H:1V slope or steeper), seeding application rates in Tables 02930-1A, 02930-1B, and 02930-1C should be doubled.
 - d. Prepare the area to be seeded by loosening the soil to a minimum depth of 3 inches. This is critical to allow seeds to filter into the soil to avoid washout from runoff.
 - e. Apply commercial grade, slow release complete fertilizer, for interim vegetation only, at a rate of 150 lbs/acre at the time of preparing the seedbed for seeding.
 - f. Install seed by broadcasting evenly over the entire site using the seed rates indicated in this Section.
 - g. Rake the area after seeding.
 - h. Lightly compact the seeded area with a roller or equivalent to ensure proper soil to seed contact.
 - i. After application of seed, perform the following prior to placement of erosion mat.
 - i. For areas receiving seed mix for cell final cover permanent vegetation (Table 02930-1C), roll seeded area with a 200 to 600 pound drum roller after seeding. If surface is not accessible for the drum roller after seeding, apply sprayed mulch at 1500 pounds per acre minimum and 100 percent continuous coverage. Mix the mulch with water at a ratio of 50 pounds of mulch per 100 gallons of water.
 - ii. For areas receiving other seed mixes (Tables 02930-1A, 02930-1B or 02930-2), rake seeded area after seeding
 - j. Mulch and disc-anchor using weed free mulch at a rate of 2.0 tons per acre. Spread straw mulch, either by hand or by blowing method, at the rate of 2

air-dried tons per acre. During June through September, increase straw mulch application rate to 3 air-dried tons per acre. Application of straw mulch by the blowing method is exempt from the dust control requirements specified in Contract Documents and Fluor Fernald Traveler Package.

3. Hydroseeding Method:
 - a. This method may be used for interim vegetation only. Hydroseeding shall be a two-step process. The seed shall be applied first, followed by a separate application of the mulch. This is to ensure soil to seed contact.
 - b. The mixture tank shall be cleaned prior to use to ensure remnant seed is not introduced to the proposed seed mixture.
 - c. Prepare area to be seeded by loosening the soil to a minimum depth of 3 inches. This is critical to allow seeds to filter into the soil to avoid washout from runoff.
 - d. Apply commercial grade, slow release complete fertilizer, for interim vegetation only, at a rate of 150 lbs/acre. The fertilizer is to be mixed and applied with the mulch.
 - e. Install seed by hydroseeding evenly over the entire area using the seed rates indicated in Table 02930-2. Use a fan-type nozzle with approximately 500 gallons of water per acre to ensure even distribution.
 - f. Rake the area where accessible following seeding.
 - g. Apply sprayed mulch at a net dry weight of 2,000 pounds per acre minimum and 100 percent continuous coverage. Mix the mulch with water at a ratio of 50 pounds of mulch per 100 gallons of water.

E. Application of Crusting Agent:

1. Apply crusting agent in accordance with manufacturer's directions.
2. Unless otherwise specified by the manufacturer, dilute concentrated pine sap emulsion to ratio of 4 parts water to 1 part concentrate. Apply diluted pine sap emulsion at a rate of 2,500 gallons per acre.

3.04 MAINTENANCE

- A. Maintain the vegetated areas in satisfactory condition until acceptance of the vegetation by the Construction Manager. Maintenance of the vegetated areas includes repairing eroded areas, revegetating when necessary, watering, and mowing (if applicable). A satisfactory condition of vegetated area is defined as follows:
1. an area shall have a predominant stand of the seeded vegetation;
 2. within 3 weeks, germination must occur over 90 percent of the area with no single bare area greater than 3 square feet; and
 3. within 3 months, 90 percent of the area must be covered with mature vegetation.

- B. The above timeframes for germination and coverage requirements are to be delayed during the dormant season between November 1 and March 15 application of the seed. The performance criteria shall be measured at the beginning of the growing season (April 1) for seed applied during the previous dormant season.
- C. Areas that fail to meet these requirements shall be repaired or reseeded as necessary to produce an acceptable stand of vegetation, as specified in this Section.
- D. The acceptance inspection will be performed by the Construction Manager who will determine whether repair of vegetated areas or revegetation is required.
- E. Maintain areas with a crusting agent to ensure proper erosion control. The crusting agent shall be reapplied to eroded and bare areas as necessary.

3.05 WARRANTY

- A. Vegetated areas shall be subject to a warranty period of not less than 12 months from initial establishment of vegetation over 100 percent of the areas seeded.
- B. At the end of the warranty period, the Construction Manager will perform an inspection of the area. Seeded areas not demonstrating satisfactory condition of vegetation as specified in this Section, shall be repaired, reseeded, and maintained to meet requirements as specified in this Section at the Contractor's expense.
- C. Areas that fail to meet these requirements shall be repaired or reseeded as necessary to produce an acceptable stand of vegetation, as specified in this Section. For the OSDF Cell Final Cover vegetation only, areas that fail to meet these requirements shall be repaired as necessary and reseeded to produce an acceptable stand of vegetation by using an alternate seed mix such as hydroseeding tall fescue as determined to be appropriate by the Construction Manager.

3.06 ACCEPTANCE

- A. The vegetated areas shall be accepted at the end of the warranty period if a satisfactory condition exists as defined in this Section.
- B. After disturbed areas are stabilized and all necessary corrective work has been completed, the Construction Manager will certify in writing the final acceptance of the vegetated areas.

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3.07 CONSTRUCTION QUALITY REQUIREMENTS

- A. CQC Consultant will monitor vegetation and crusting agent application in accordance with this Section and Construction Quality Assurance (CQA) Plan.

TABLE 02930-1A

SEED MIX IN DRY AREAS FOR PERMANENT VEGETATION

SPECIES	POUNDS PER ACRE
	(lb/ac)
Big Bluestem (<i>Andropogon gerardi</i>)	3.0
Little Bluestem (<i>Andropogon scoparius</i>)	2.0
Side-Oats Grama (<i>Bouteloua curtipendula</i>)	0.5
Indian Grass (<i>Sorghastrum nutans</i>)	2.0
Canada Wild-Rye (<i>Elymus canadensis</i>)	25
Switch grass (<i>Panicum virgatum</i>)	0.5
ReGreen (NA)	5.0
Wildflowers ⁽¹⁾ :	1.5
Butterflyweed (<i>Asclepias tuberosa</i>)	
Smooth Aster (<i>Aster laevis</i>)	
Ox-eye Sunflower (<i>Heliopsis helianthoides</i>)	
Bergamot (<i>Monarda fistulosa</i>)	
Purple Coneflower (<i>Echinacea purpurea</i>)	
Yellow Coneflower (<i>Ratibida pinnata</i>)	
Black-Eyed Susan (<i>Rudbeckia hirta</i>)	
Spiderwort (<i>Tradescantia ohioensis</i>)	
Hoary Vervain (<i>Verbena stricta</i>)	
Beardtongue (<i>Penstemon grandiflorus</i>)	
Sweet Joe Pye-Weed (<i>Eupatorium purpureum</i>)	
Blue False Indigo (<i>Baptisia australis</i>)	
Partridge Pea (<i>Cassia fasciculata</i>)	
Rattlesnake Master (<i>Eryngium yuccifolium</i>)	
Round-headed Bush Clover (<i>Lespedeza capitata</i>)	
Stiff Goldenrod (<i>Solidago rigida</i>)	

Note: (1) Wildflower mix to be apportioned according to species aggressiveness and seed counts as approved by the Construction Manager. If certain species are not available, appropriate substitutions will be approved by the Construction Manager.

TABLE 02930-1B

SEED MIX IN WET AREAS⁽¹⁾ FOR PERMANENT VEGETATION

Species	POUNDS PER ACRE
	(lb/ac)
Big Bluestem (<i>Andropogon gerardi</i>)	3.0
Canada Wild-Rye (<i>Elymus canadensis</i>)	25
S Grass (<i>Panicum virgatum</i>)	0.5
Blue Joint Grass (<i>Calamagrostis canadensis</i>)	0.5
Porcupine Sedge (<i>Carex hystericina</i>)	1 ounce per acre (oz/ac)
Fox Sedge (<i>Carex stipata</i>)	1 ounce per acre (oz/ac)
Dark Green Bulrush (<i>Scirpus atrovirens</i>)	1 ounce per acre (oz/ac)
ReGreen	5.0
Prairie Cordgrass (<i>Spartina pectinata</i>)	1.0
Wildflowers ⁽²⁾ :	1.5
Red Milkweed (<i>Asclepias incarnata</i>)	
New England Aster (<i>Aster novae-angliae</i>)	
Wild Senna (<i>Cassia hebecarpa</i>)	
Great Blue Lobelia (<i>Lobelia siphilitica</i>)	
Yellow Coneflower (<i>Ratibida pinnata</i>)	
Blue Vervain (<i>Verbena hastata</i>)	
Sweet Joe-Rye Weed (<i>Eupatorium purpureum</i>)	
Cardinal Flower (<i>Lobelia cardinalis</i>)	
Sawtooth Sunflower (<i>Helianthus grosseserratus</i>)	

- Notes: (1) Seeding in drainage ditches or swales shall contain erosion mats as specified in Section 02270 after application of seed mixture. Erosion mat shall cover a minimum width of 12 feet.
- (2) Wildflower mix to be apportioned according to species aggressiveness and seed counts as approved by the Construction Manager. If certain species are not available, appropriate substitutions will be approved by the Construction Manager.

TABLE 02930-1C

SEED MIX IN SANDY DRY AREAS⁽¹⁾ FOR PERMANENT VEGETATION

Species	POUNDS PER ACRE (lb/ac)
Grass	
Big Bluestem (<i>Andropogon geradi</i>)	0.5
Little Bluestem (<i>Andropogon scoparius</i>)	3.0
Side-Oats Grama (<i>Bouteloua curtipendula</i>)	5.0
Canada Wild-Rye (<i>Elymus Canadensis</i>)	25
Indian Grass (<i>Sorghastrum nutans</i>)	0.5
Annual Rye (<i>Lolium multiflorum</i>)	5.0
Prarie Dropseed (<i>Sporobolus heterolepis</i>)	1.5
	Ounces Per Acre (oz/ac)
Wildflower, Uniform mix of the following species:	
Butterflyweed (<i>Asclepias tuberosa</i>)	5.0
Smooth Aster (<i>Aster laevis</i>)	0.25
Ox-eye Sunflower (<i>Heliopsis helianthoides</i>)	1.75
Bergamot (<i>Monardara fistulosa</i>)	0.25
Purple Coneflower (<i>Echinacea purpurea</i>)	3.0
Yellow Coneflower (<i>Ratibida pinnata</i>)	0.25
Black-Eyed Susan (<i>Rudbeckia hirta</i>)	0.25
Hoary Vervain (<i>Verbena stricta</i>)	0.5
Beardtongue (<i>Penstemon grandiflorus</i>)	1.0
White False Indigo (<i>Baptisia leucantha</i>)	4.0
Blue False Indigo (<i>Baptisia australis</i>)	4.0
Partridge Pea (<i>Cassia fasciculata</i>)	3.0
Stiff Goldenrod (<i>Solidago risida</i>)	0.25
Lupine (<i>Lupinus peremis</i>)	7.0

Notes: (1) Wildflower mix to be apportioned according to species aggressiveness and seed counts as approved by the Construction Manager. If certain species are not available, appropriate substitutions will be approved by the Construction Manager.

TABLE 02930-1C

SEED MIX FOR CELL FINAL COVER⁽¹⁾ PERMANENT VEGETATION

Species	POUNDS PER ACRE (lb/ac)
Grass	
Little Bluestem (<i>Andropogon scoparius</i>)	3.0
Side-Oats Grama (<i>Bouteloua curtipendula</i>)	5.0
Buffalo Grass (<i>Buchloe dactyloides</i>)	1.0
Canada Wild-Rye (<i>Elymus Canadensis</i>)	25
Annual Rye (<i>Lolium multiflorum</i>)	10
Prairie Dropseed (<i>Sporobolus heterolepis</i>)	1.5
Wildflower, Uniform mix of the following species	
OUNCES PER ACRE (oz/ac)	
Butterflyweed (<i>Asclepias tuberosa</i>)	3.0
Smooth Aster (<i>Aster laevis</i>)	0.25
Blue False Indigo (<i>Baptisia australis</i>)	3.5
Ox-eye Sunflower (<i>Heliopsis helianthoides</i>)	1.75
Bergamot (<i>Monarda fistulosa</i>)	0.25
Purple Coneflower (<i>Echinacea purpurea</i>)	2.0
Yellow Coneflower (<i>Ratibida pinnata</i>)	0.375
Black-Eyed Susan (<i>Rudbeckia hirta</i>)	0.125
Spiderwort (<i>Tradescantia ohioensis</i>)	1.0
Hoary Vervain (<i>Verbena stricta</i>)	0.5
Beardtongue (<i>Penstemon grandiflorus</i>)	1.0
Partridge Pea (<i>Cassia fasciculata</i>)	32
Stiff Goldenrod (<i>Solidago rigida</i>)	0.75

Notes: (1) Wildflower mix to be apportioned according to species aggressiveness and seed counts as approved by the Construction Manager. If certain species are not available, appropriate substitutions will be approved by the Construction Manager.

TABLE 02930-2
SEED MIX FOR INTERIM VEGETATION

Species	Pounds Per Acre (lb/ac)
ReGreen	50
Partidge Pea (<i>Cassia fasciculate</i>)	10
Canada Wild Rye (<i>Elymus Canadensis</i>)	40

[END OF SECTION]