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SECTION 02220 - EARTHWORK, DAMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

Work under this SECTION covers requirements for materials, tools, equipment and services necessary to complete the Earth Dams for this project. The work shall include, but is not necessarily limited to, completion of the following work:

1. Field engineering
2. Excavation
3. Dewatering of excavations prior to filling as may be required
4. Conveyance, placement, and compaction of excavated materials
5. Chemical/mechanical soil stabilization as may be required
6. Implementation of Storm Water Pollution Prevention Plan (SWPPP)

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this SECTION.

B. Use equipment adequate in size, capacity, and numbers to accomplish the work in a timely manner.

C. In addition to complying with requirements of governmental agencies having jurisdiction, comply with the directives of Engineer and Division.

D. References

1. ASTM D1556: Density of Soil-in-Place by Sand-Cone Method or other equivalent method with Engineers approval.

2. ASTM D698: Moisture-Density Relations of Soils and Soil-Aggregate Mixtures – Standard Proctor Test.

3. ASTM D2922: Density of Soil and Soil Aggregate In-Place by Nuclear Methods.

4. ASTM D3017: Standard Test Method for Water Content of Soil and Rock In-place by Nuclear Methods.

5. ASTM D2487: Unified Soil Classification System (USCS).

6. ASTM D4253: Maximum Index and Unit Weight of Soils Using a Vibratory Table.

7. ASTM D4254: Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

8. ASTM D558: Moisture-Density Relations of Soil-Cement Mixtures.

9. ASTM D422: Particle-Size Analysis of Soils.

10. ASTM D4318: Liquid Limit, Plastic Limit and Plasticity Index of Soils.

11. Iowa Department of Transportation Standard Specifications for Highway and Bridge Construction (IDOT).

E. The Division/Engineer will retain the services of a Geotechnical Engineer to provide inspection of the core trench, material evaluation and approval, and compaction testing of fill where required. Contractor shall be responsible for coordinating and providing advance notice of any operations involving these components to allow adequate time for scheduling and testing.

1.3 JOB CONDITIONS

A. Nature of Work Site

1. Materials to be handled under this Contract include quantities of spoil, gob, and coal refuse which may be toxic and/or acidic in nature.

2. The Project site is situated in an area where underground coal mining could have been conducted. There is a possibility that mine drifts or shaft openings are present on site. Contractor shall exercise reasonable caution in recognition of this potential hazard, and shall notify Engineer immediately upon discovery of any openings. Sealing of openings will be incorporated into this Contract through issuance of change orders, as required. Additional specifications will be provided by Division as needed.

3. During excavation in existing spoil piles, Contractor shall recognize possible existence of cavities or smoldering fires and, if encountered, shall notify Engineer promptly. Contractor shall exercise caution and be prepared to take appropriate actions since accelerated combustion may occur. Burning materials shall be extinguished before being covered or incorporated as fill. Contractor shall notify Division and Engineer if smoldering fires are encountered.

4. Spoil material used to construct fills is subject to significant increase in pore water pressure, particularly during rapid construction, with a corresponding decrease in shear strength, and thus slope stability. Contractor shall exercise caution and notify Engineer and Division promptly should signs of slope instability appear.

1.4 PERMITS AND FEES

A. Division has obtained any required permits from the Iowa Department of Natural Resources (IDNR) as required for construction of the dam(s) on this Project. All requirements of the permit(s) have been incorporated into the Construction Specifications and Plans.

1.5 SUBMITTALS

A. Contractor shall submit or assist with obtaining samples of all on-site or off-site materials intended to be used to complete the work included in this SECTION. The samples shall be obtained by or submitted to the designated Geotechnical Engineer at least ten (10) working days in advance of its intended use. All samples shall be marked with its source and intended use.

B. The Geotechnical Engineer shall make appropriate examinations, classifications, and perform necessary tests to determine the suitability of the material for its intended use. Engineer will notify Contractor of the suitability of the submitted samples. Any submitted samples deemed unsuitable shall not be used as intended and new samples must be submitted to or obtained by the Geotechnical Engineer.

C. Contractor shall schedule and coordinate all construction activities requiring observation and testing with Engineer and/or Construction Observer and the designated Geotechnical Engineer.

D. Copies of all laboratory and field tests will be provided to Contractor, Engineer and Division.

PART 2 - PRODUCTS

2.1 FILL MATERIAL

A. Impervious Fill Material: Material used as impervious fill in areas designated on the Plans shall be obtained from the area(s) indicated on the Plans as Impervious Fill Material, or in areas as approved by Engineer and Division. Impervious Fill Material shall consist of clay or weathered shale materials that do not have less than sixty percent (60%) by dry weight passing a Standard No. 200 U.S. Sieve. Impervious fill shall be sorted to remove all material having any dimension greater than four (4) inches. All impervious fill shall be classified as CL, CH, or CL-CH in accordance with Unified Soil Classification System (USCS). All impervious fill shall be free from debris, roots, organic matter, frozen material, and coal refuse. Any layers or pockets of granular materials encountered within impervious fill borrow shall not be incorporated as impervious fill.

B. General Fill Material: General fill materials consist of spoil piles, coal refuse materials, gob and all other soil material from required cut operations. All boulders, large rocks, organic matter, frozen material, and miscellaneous debris shall be sorted out and not used within the footprint of the dam.

2.2 FILTER SAND

A. Material used to construct the filter blanket and the toe drain backfill shall conform to one of the following IDOT gradations. Fine aggregate shall not be of calcareous (limestone) nature. Submit material certifications to Engineer.

SECTION 4112, PCC Intermediate, Gradation No. 2.
SECTION 4117 (Class V), PCC FA & CA, Gradation No. 7
SECTION 4131, Porous Backfill, Gradation No. 29
SECTION 4134 (Natural Sand), Floodable Backfill, Gradation No. 36

2.3 DAM OUTLET STRUCTURES

A. Refer to SECTION 02310 - DRAINAGE STRUCTURES, DAMS

2.4 SELECT BORROW

A. Refer to SECTION 02250 - EARTHWORK, SELECT BORROW

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this SECTION will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.2 ELEVATIONS AND LINES

A. Contractor shall stake the alignment and grades of earth dams in the field as shown on the Plans.

B. Rough grading shall be to within three-tenths (0.3) feet of lines and grades as shown on the Plans.

C. The crest of the dam at its midpoint shall be overbuilt as indicated on the Plans to accommodate anticipated future settlement. The overbuilt crest of the dam shall taper from its mid-point to zero (0) inches at both abutments.

3.3 MAINTENANCE

A. Protection of newly graded areas.

1. Protect newly graded areas from traffic and erosion, and keep free from trash and weeds.

2. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.

B. Contractor shall scarify the surface, reshape, and compact (if necessary) any areas where grading is completed that becomes disturbed by subsequent construction operations or adverse weather, prior to further construction.

C. Contractor shall maintain new and existing drainage ways free from detrimental quantities of sediment, leaves, sticks, trash and other debris during execution of the work.

D. Contractor shall maintain access to adjacent areas at all times.

E. Contractor shall implement the approved SWPPP for this Project and conduct all excavation and select borrow placement activities to minimize losses due to erosion and sedimentation of adjacent areas.

3.4 WATER CONTROL

A. Contractor shall furnish, install, operate, and maintain all necessary and sufficient equipment and methods for controlling surface water and groundwater during construction of the earthen dam.

B. Cofferdams may be used to divert water or collect water for pumping to protect the earth dam during construction. Cofferdams should be located beyond the limits of the proposed earth dam. The cofferdam(s) shall be removed after completion of the dam unless other arrangements are made with Engineer and Division.

C. All excavations required for construction of the earth dam and drainage structures shall be dewatered as necessary to prevent excessive disturbance of exposed subgrade and allow for fill placement and compaction. Dewatering should be accomplished using pumps, drains, or other suitable methods.

3.5 SUBGRADE PREPARATION

A. Contractor shall remove all vegetation, topsoil, soft, or otherwise unsuitable material from the footprint of the dam as shown on the plans. Excavate further as needed to the subgrade elevation lines shown on the plans.

B. The exposed subgrade shall be proofrolled with heavy equipment such as a loaded scaper or tandem-axle dump truck in the presence of the Geotechnical Engineer, and Engineer or Division. Soft or disturbed areas shall be improved by disking, drying, and compacting with a sheep's foot roller or by overexcavating and replacing with suitable, properly compacted, impervious fill. The

area and depth of the overexcavation as approved by Division and Engineer shall be jointly measured by Engineer and Contractor for payment quantities prior to backfilling.

3.6 CORE TRENCH

A. The core trench shall be excavated in the location shown on the plans after the dam footprint has been has been stripped, proofrolled, and corrected as needed. The core trench shall extend to the minimum width and depth as shown on the plans, unless bedrock is encountered or conditions warrant additional excavation as determined by the Geotechnical Engineer.

B. The Geotechnical Engineer and Engineer shall observe the core trench prior to backfilling. If additional excavation is required due to the site conditions, the Division shall be informed immediately and this additional excavation shall be measured for payment. If additional excavation is required due to inadequate water control measures or construction techniques used by Contractor, this additional excavation and backfilling shall be completed at no additional cost to Division.

C. The final core trench dimensions shall be measured jointly by Contractor and Engineer prior to backfilling. Only the amount of excavation approved by Engineer and Division shall be computed for payment. Additional excavated areas extending beyond the amount approved shall be properly backfilled at no additional cost to Division. Any survey information obtained by Contractor shall be provided to Engineer.

D. The core trench shall be backfilled with impervious fill after receiving approval by Engineer. The impervious fill shall be placed and compacted in accordance with the requirements of this Section.

E. The core trench shall be dewatered when necessary to allow for observations by Engineer and during fill placement. Subgrade and fill materials that become disturbed or too wet for proper compaction shall be removed and replaced at no additional cost to Division.

3.7 IMPERVIOUS FILL PLACEMENT - DAM

A. Impervious fill, as approved by the Geotechnical Engineer, shall be placed in the core trench and within the designated areas of the embankment. Impervious fill shall also be placed as the pond liner where indicated on the Plans.

B. Impervious fill shall be placed in horizontal lifts for the core trench and dam. Vertical benches shall be cut into adjacent slopes as needed to allow for horizontal placement.

C. Impervious fill shall be placed and spread in horizontal, loose lifts of no more than nine (9) inches and compacted to at least ninety-five percent (95%) of the material's maximum standard Proctor dry density.

D. The moisture content of the impervious fill shall be adjusted as needed by disking and drying or wetting the material to be within the range of minus two percent (-2%) to plus four percent (+4%) of the material's optimum moisture content as determined by the standard Proctor test.

E. Compaction of impervious fill and general fill within the footprint of the dam and for the pond liner shall be accomplished with a sheep's foot roller meeting IDOT Section 2001.05A, Tamping-type rollers. Manual compaction equipment shall be used as required to prevent damage to structures and shall meet the same compaction requirements. No other types of compaction equipment will be allowed for placement of impervious fill, unless written approval is obtained from Division or Engineer.

F. The exposed surface shall be properly prepared prior to placement of each subsequent lift. If the exposed surface becomes too smooth to bond to the next layer, the existing layer shall be scarified. If the exposed surface becomes excessively dry or moist, the surface shall be scarified and moisture conditioned as necessary before placing subsequent fill layers.

G. Impervious fill shall not be placed during periods of freezing weather or over frozen materials. Frozen material shall not be used as impervious fill.

3.8 IMPERVIOUS FILL PLACEMENT- POND LINER

A. The subgrade in pond areas to receive impervious fill shall be established to allow the design thickness of impervious material to be placed.

B. The exposed subgrade shall be disked to a depth of at least six (6) inches and observed by the Geotechnical Engineer. Areas with sandy or otherwise unsuitable materials will be overexcavated and replaced with impervious fill. The overexcavation will extend so that at least two (2) feet of compacted and impervious material is present over sandy material. The exposed subgrade shall be moisture conditioned as necessary to be within minus two percent (-2%) to plus four percent (+4%) of the standard Proctor optimum moisture content. The disked subgrade material shall be compacted to at least ninety percent (90%) of the material's standard Proctor maximum dry density.

C. Impervious fill for the pond liner shall be placed in loose lift thicknesses or no more than eight (8) inches and compacted to at least ninety percent (90%) of the material's maximum standard Proctor dry density at a moisture content between minus two percent (-2%) and plus four percent (+4%) of the material's maximum standard Proctor moisture content.

3.9 CONTROLLED GENERAL FILL PLACEMENT

A. Controlled general fill materials shall be placed in the portions of the dam as shown on the plans adjacent to the impervious fill areas to the rough grade shown on the plans. General fill shall be placed concurrently with impervious fill.

B. Controlled general fill placed within the footprint area of the dam shall be placed in horizontal lifts not to exceed twelve (12) inches in loose thickness. Each lift shall be compacted to at least ninety percent (90%) of the material's maximum standard Proctor dry density. The moisture content of the general fill placed adjacent to the impervious fill within the footprint of the dam shall be adjusted as needed by disking and drying or wetting to be within minus two percent (-2%) to plus four percent (+4%) of the material's optimum moisture content as determined by the standard Proctor test.

C. Compaction of controlled general fill within the footprint area of the dam shall be accomplished with a sheep's foot roller meeting IDOT Section 2001.05A, soil compaction rollers. Manual compaction equipment shall be used as required to prevent damage to structures and shall meet the same compaction requirements. No other compaction equipment will be allowed for placement of impervious fill, unless written approval is obtained from Division.

D. Controlled general fill shall not contain frozen materials, be placed over frozen material, or be placed during a period of freezing weather.

3.10 INTERNAL DRAINS

A. The dam construction may include installation of internal drains such as a downstream drainage blanket, chimney drain, and/or toe drain. Placement of impervious and general fill shall be completed in a manner that insures these drains function properly.

B. Refer to SECTION 02310 – DRAINAGE STRUCTURES – DAMS and to the Plans for further details.

3.11 OUTLET STRUCTURES

A. The dam construction may include installation of both primary and emergency spillways. Refer to SECTION 02310 – DRAINAGE STRUCTURES – DAMS and to the Plans for further details.

3.12 SELECT COVER PLACEMENT

A. When select cover material is required, this material shall be placed after completion of construction of the earthen dam at the locations and with the thickness shown on the Plans. Refer to SECTION 02250 – EARTHWORK, SELECT BORROW.

3.13 TESTING

A. Division shall pay all field and laboratory soil tests to ensure that proper compaction and moisture control are being achieved. All test data shall be regularly submitted by the selected Geotechnical Engineer to Engineer, Division, and Contractor.

B. A minimum of one (1) standard Proctor test shall be performed on each cohesive material type used to construct the dam. Additional laboratory tests will be performed as needed to determine the material's suitability for its intended use.

C. In-place field density tests shall be performed in sufficient number and locations to ensure that the impervious fill is being placed and compacted in accordance with the Construction Specifications. As a minimum, one (1) test shall be performed for every two (2) feet of loose fill thickness placed and at a maximum spacing of one-hundred (100) feet along the length of the dam both within the impervious fill and general fill sections. Tests performed for the pond liner shall be taken as needed to insure proper compaction and no less than on a one-hundred (100) foot grid for each lift, including the subgrade.

D. All areas with failing tests shall be reworked by Contractor and retested by the Geotechnical Engineer until the required compaction and the proper moisture content is achieved.

E. Additional or supplemental field or laboratory tests requested by or conducted for the convenience of Contractor shall be completed at no additional cost to Division.

3.14 MEASUREMENT AND PAYMENT

The construction cost of all work included in this SECTION of the Construction Specifications shall be included in Contractor's unit prices set forth in the Proposal and Schedule of Prices (*Document C*) for the work items described below. The unit price for each of these items shall include its pro rata share of overhead so that the sum of the products obtained by multiplying the unit prices so set forth by the amount of the work actually constructed, measured as described herein, shall constitute full payment to Contractor for performance of the work included in this SECTION.

Measurement and payment for each work item in this SECTION shall be in accordance with the following:

A. *Undercut Excavation, Earth Dam*: The unit price for this item shall include all equipment, materials, and labor to remove material below the footprint of the dam as discussed in the Subgrade Preparation and Core Trench portions of this SECTION. Said unit price shall constitute full payment for undercut excavation, and all incidental work pertaining thereto. Excavations for dewatering and cofferdams, if needed, are incidental to construction of the embankment and will not be included in the undercut quantity. Excavation for toe drains, filter sand, and outlet works conduit, if needed, will not be measured for payment and this associated cost should be included in the unit prices for each of these items.

Contractor will be paid for the undercut excavation based on conditions encountered during construction. The undercut area will be jointly measured by Contractor and Engineer. The backfill required for any overexcavation will be paid for as impervious fill. Any undercut excavation and associated backfill not approved by Engineer and Construction Observer will not be measured for payment.

Contractor shall be paid at the unit price for "Undercut Excavation" for each cubic yard as measured above. The quantity of cubic yards for the undercut excavation included in the bid items have been separated out of the overall excavation required for rough grading.

B. *Impervious Fill, Earth Dam and Pond Liners:* The unit price for this item shall include all equipment, materials, and labor required to properly place approved material in the core trench, undercut excavation, and within the designated area of the dam and pond liner as shown on the on the plans. Said unit price shall constitute full payment for dewatering, moisture adjustment and compaction, and all incidental work pertaining thereto.

Contractor will be paid for the bid quantity of impervious fill for the earth dam provided in the specifications unless additional undercut excavation was required or other changes were needed based on conditions encountered during construction. If additional undercut excavation was required, the approved quantity will be added to the bid quantity for impervious fill. If other areas of impervious fill were required by Engineer that are not shown on the plans or were not measured as part of the undercut, these areas will be jointly measured by Contractor and Engineer/Construction Observer. Any impervious or general fill placed in undercut excavations not approved by Engineer will not be measured for payment.

Contractor shall be paid at the unit price for "Impervious Fill" for each cubic yard compacted in place and as measured above. The quantity of cubic yards for the impervious fill included in the bid items have been separated out of the overall excavation required for rough grading and has been adjusted for the shrinkage rate indicated in the Supplemental Specifications or Plans.

C. *Controlled General Fill, Earth Dam:* The unit price for this item shall include all equipment, materials, and labor required to properly place approved material within the designated area of the dam as shown on the on the plans. Said unit price shall constitute full payment for dewatering, moisture adjustment and compaction, and all incidental work pertaining thereto.

Contractor will be paid for the bid quantity of controlled general fill for the earth dam as shown on the plans and in any other areas requested by Division and Engineer. Any controlled general fill placed in areas not approved by Engineer or Division will not be measured for payment. The quantity of cubic yards for the controlled general fill included in the bid items have been separated out of the overall excavation required for rough grading and has been adjusted for the shrinkage rate indicated in the Supplemental Specifications or Plans.

D. *Summary:* Proposal Bid Items applicable to work covered by this SECTION are as follows:

Description	Unit
Undercut Excavation, Earth Dam	Cu. Yd.
Impervious Fill, Earth Dam	Cu. Yd.
Impervious Fill, Pond Liner	Cu. Yd.
Controlled General Fill, Earth Dam	Cu. Yd.

END OF SECTION 02220