

IOWA DEPARTMENT OF NATURAL RESOURCES

DIVISION II
SITE WORK

IOWA DEPARTMENT OF NATURAL RESOURCES
ENGINEERING AND REALTY SERVICES BUREAU
WALLACE STATE OFFICE BUILDING
DES MOINES, IA 50319-0034

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes: The work covered by this section consist of site clearing, grading, general and building excavation, disposal of debris and spoils, dewatering preparation of subgrade, foundations, borrow, embankment, structural and general backfill, restoration, and cleanup necessary to construct the project, all as shown on the drawings and as specified herein.
- B. Related Sections: Drawings and General Provisions of the Contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements as well as, but not limited to, the following:

Section 02930 - Lawns and Grasses
Section 03100 - Concrete Formwork
Section 03300 - Cast-In-Place Concrete

1.02 QUALITY ASSURANCE:

- A. Codes and Standards: Perform all excavation work in compliance with applicable requirements of governing authorities having jurisdiction.
- B. Safety: All excavation work and methods of construction shall conform to the state of Iowa Bureau of Labor and all OSHA Standards.

1.03 JOB CONDITIONS:

- A. Site information shown on the Drawings regarding existing conditions is of a general nature. Visit the site and become familiar with existing conditions.
- B. Observe weather conditions. Attempt no work in frozen conditions without the approval of the DNR Construction Inspector.

1.04 PROTECTION OF PERSONS AND PROPERTY:

- A. Protect from damage existing buildings, walks, paving, fencing, sod, and other items noted to remain. Maintain benchmark, monuments, property stakes, and other reference points.
- B. Protect existing underground utilities to remain.
 - 1. Notify the DNR Construction Inspector of underground utilities or structures encountered but not indicated on drawings.
 - 2. Contractor responsibilities: correcting damage caused to existing construction, utilities, surfacing, and other items noted to remain at no additional expense to the Owner.
- C. Barricade open excavations occurring as part of this work and provide warning lights.

1.05 EXPLOSIVES:

- A. The use of explosives is not permitted.

PART 2 - PRODUCTS

2.01 GENERAL FILL AND EMBANKMENT MATERIAL:

- A. Materials to be incorporated in the top 12 inches of earth embankment or general fill shall be earthy materials, free from stones larger than 2 inches, broken concrete, roots, or other materials that would significantly affect scarifying, compacting and finishing the subgrade.
- B. It is anticipated that the majority of excavation material from the building excavation will be acceptable for this use.
- C. Obtain approval of fill material prior to any placement from the DNR Construction Inspector.

2.02 STRUCTURAL BACKFILL MATERIAL:

- A. Structural backfill material shall consist of a natural sand or a mixture of sand with gravel, crushed stone, or other broken fine material to fill all voids in coarser material.
 - 1. The maximum size of any gravel, stone, or broken or fragmented material shall be of such size that 100 percent passes a 6-inch sieve.
 - 2. The liquid limit of the material shall not be greater than 25 and the plasticity index shall not be more than 6.
 - 3. The portion of the material, which passes a No. 4 sieve, shall conform to the following requirements:

<u>Sieve Size</u>	<u>Percentage By Weight Passing</u>
No. 4	100
No. 40	Not more than 75
No. 100	Not more than 15
No. 200	Not more than 8

- B. The material shall be capable of being compacted to 95 percent maximum density without undue weaving and heaving as defined by ASTM D698, Method D.
- C. Obtain approval of fill material prior to any placement from the DNR Construction Inspector.

2.03 GRANULAR DRAINAGE FILL MATERIAL:

- A. Granular drainage fill for use under concrete slabs and walks where shown on the Drawings shall consist of granular free-draining material; consisting of clean bank run gravel or crushed stone of full range of sizes.

- B. Maximum size of aggregate shall be 3/4 inch. 15 to 50% of that portion of weight of fill shall be passing the No. 4 sieve.

2.04 TOPSOIL:

- A. Topsoil: Friable clay loam surface soil reasonably free of subsoil, clay lumps, stones and other objects over two inches in diameter, and without weeds, roots and other objectionable materials.

PART 3 - EXECUTION

3.01 SITE CLEARING:

- A. General: Remove all vegetation, improvements, or obstructions interfering with installation of new construction.
 - 1. Removal includes digging out of stumps, roots, boulders and any other necessary items, the removal of which is not covered in the work of another section.
- B. Clearing and Grubbing: Clear site of trees, shrubs, and other vegetation, except those indicated or directed to be left standing.
 - 1. Completely remove stumps, roots, boulders and other debris protruding through the ground.
 - 2. Use only hand methods for grubbing inside drip line of trees indicated to be left standing.
 - 3. Depressions: Fill depressions caused by clearing and grubbing operations with satisfactory soil materials, unless further excavation work is required or indicated.

3.02 LAYING OUT WORK:

- A. Commission surveyor to locate new construction, set slope and grade stakes, and otherwise fully lay out work.
 - 1. Provide grade staking to maintain proper grades and control.
 - 2. Check existing grades at site against grades or contours indicated on Drawings, and report any differences to Architect before starting of grading.
 - 3. Stake out building and verify location before start of grading.
- B. Preserve stakes and markers.
 - 1. Replace at no cost to the Owner' stakes or markers carelessly or willfully damaged by operation.
 - 2. Assume responsibility for accuracy of lines, grades, and dimensions.

3.03 STRIPPING AND SALVAGING OF TOPSOIL:

- A. Preparation: Mow or otherwise remove weed grass and other vegetation on entire area expected to be disturbed by the work of this section.
- B. Sod: Shred sod by shallow plowing, blading or disking throughout the entire area.
- C. Excavation of Topsoil: Excavate topsoil throughout the entire prepared area to a depth of 12 inches and stockpile where designated by DNR Construction Inspector.

3.04 DEWATERING:

- A. Dewatering System: Provide, maintain and operate sufficient well points, headers, pumps, trenches, and sumps to keep all excavations for structures free from water at all times. Submit proposal to the DNR Construction Inspector for review prior to construction.
- B. Surface Runoff: Control grading around the excavation to prevent surface water from running into the excavations for the structure.
- C. Saturated Foundations: Prior to placing any concrete for foundations, remove soils in footing excavation that have become saturated with surface water.

3.05 EXCAVATION - GENERAL:

- A. General: General excavation consists of removal of materials of whatever nature, including boulders smaller than 1 cubic yard in volume, required for the construction of structures, roads, and walks.
 - 1. The method of excavating shall be at the Contractor's option, exercising great care to leave the final grade in an undisturbed condition.
 - 2. If final grade is disturbed, restore to requirements and satisfaction of the DNR Construction Inspector/Architect.
 - 3. Prior to placing any concrete for footings and foundation work, notify the DNR Construction Inspector to inspect the excavation and obtain approval to proceed with the placement.
- B. Frozen Ground: Provide frost protection for all structural excavation work and do not place concrete for foundation work on frozen ground.
- C. Protection of Existing Work: Protect existing work, including underground utilities and piping, from damage caused by excavation work.
 - 1. Repair any damage to existing work, utilities, or piping at Contractor's expense.
- D. Storage of Fill Materials: Store suitable excavated fill material away from excavations to avoid slides.
 - 1. Deposit excess earth on site, where directed by DNR Construction Inspector.

- E. Removal of Unsuitable Materials: The DNR Construction Inspector may find that changes to cross-sectional dimensions and depths shown on Drawings are necessary to secure foundations free from soft, weathered, shattered and loose materials or other objectionable materials.
 - 1. Remove unsuitable material encountered and replace with granular materials from established pits satisfactory to the DNR Construction Inspector.
 - 2. Compact granular materials to at least 95 percent of maximum density.
 - 3. When the excavation of unsuitable materials and replacement with granular fill material directed by the DNR Construction Inspector is found to be above normal expectations, it will be paid for at the unit prices listed in the Contractor's submitted cost breakdown.
 - a. What constitutes normal expectations will be determined by the Architect.
 - b. The Architect's decision will be final.
- F. Disposal of Excavated Materials: Materials free from sticks, roots, and other objectionable material may be used on site as directed by the DNR Construction Inspector.
 - 1. Remove excavated materials not suitable for fill as directed by the DNR Construction Inspector.

3.06 STRUCTURAL EXCAVATION:

- A. Excavate to elevations and dimensions indicated on the Drawings; allow additional space as required for construction operations and inspection.
- B. Remove all existing construction, encountered within the excavation, to a depth of 6 inches below the indicated elevation of footings and subgrades, to receive floor slabs, walks, and paving.
- C. If suitable bearing for foundations, is not encountered at depth indicated on the Drawings, immediately notify the DNR Construction Inspector.
 - 1. Do not proceed until instructions are given and necessary measurements made for the purpose of establishing additional volume of excavation.
- D. Excavate last 4 inches by hand, if machines are used for excavation.
- E. Fill with concrete, at Contractor's expense, unauthorized excavation carried below bottom of foundation levels shown.
- F. The DNR Construction Inspector will inspect and approve the bottoms of all excavation prior to concrete placement.

3.07 STRUCTURAL BACKFILL:

- A. Start backfill around foundations not less than 24 hours or more than seven (7) days after application of waterproofing.

1. Backfill walls and piers to about the same elevation on each side to equalize pressure.
- B. Compacted structural backfill to 95 percent of its maximum density.
 1. Compact to density and construction requirements as determined by ASTM D698, Method D or by AASHTO Method T-180 (Modified Proctor Density).
- C. Compact subgrade to receive structural backfill to 95 percent density.

3.08 DRAINAGE FILL UNDER INTERIOR SLABS:

- A. Unless otherwise indicated on the Drawings, place a 6-inch minimum layer of granular drainage fill.
- B. Compact this fill material to 95 percent of maximum density at optimum moisture content.

3.09 DRAINAGE FILL UNDER EXTERIOR SLABS:

- A. Provide 4-inch minimum layer of granular drainage fill sub-base for exterior concrete slabs.
- B. Compact with mechanical platform tamper or as approved by DNR Construction Inspector.

3.10 PLACING BACKFILL ADJACENT TO WALLS AND FOOTINGS:

- A. Deposit fill on each side of piers, walls and freestanding structures simultaneously to approximately the same elevation.
 1. Protect below grade waterproofing, dampproofing and insulation with a single thickness of 1/2" fiberboard, 1/8" asphalt impregnated board or other approved means.
 2. Place fill in workable condition, free of clods, frost, or debris, in 6" lifts and thoroughly compact each lift with mechanical tamper.
- B. Do not operate heavy equipment for spreading and compacting backfill closer to any wall than a distance equal to the height of the backfill above the top of the footings.
 1. Backfill adjacent to walls shall be compacted to the same density as the adjacent fill with a small vibratory or hand tamping compactor.

3.11 PREPARATION OF EARTH SUBGRADE FOR CONCRETE:

- A. When excavating for footings or bottom mat slabs to be cast on native soil, excavate to final grade in a manner as to not disturb the existing soil.
 1. If the soil is disturbed, compact it to the satisfaction of the DNR Construction Inspector.
 2. If the soil is not capable of compaction to the satisfaction of the DNR Construction Inspector, remove the disturbed material, and replace it with thoroughly compact structural backfill material.
- B. Do not place concrete on surfaces that are muddy, frozen or contain frost.

- C. If during the course of construction, bottom surfaces become saturated with water or muddy, remove the undesirable material and replace with compacted structural backfill as indicated above.

3.12 PLACING PIPE IN FILL:

- A. When it is necessary to place pipe culverts, drain piping, or other appurtenances in general or structural backfill, bring the fill up to at least one foot above the top of the pipe or appurtenances.
 - 1. Do not leave areas of backfill depressed to allow for trenches.
 - 2. After the compacted fill is complete, excavate for the pipe or appurtenances.
 - 3. Backfill materials and compaction shall conform to the fill in which it is placed.

3.13 TRIMMING AND CLEAN UP:

- A. Conduct final trimming and cleaning up shall as follows:
 - 1. Smooth out all irregularities, fill all washouts, make slopes uniform, slightly rounded at top and bottom, and compact the entire area of the fill to the required lines, grades and cross sections, within 1/10 foot above or below the established grade.
 - 2. Where additional material is required, provide similar fill as the one used, and obtain such material from source approved by the Architect/DNR Construction Inspector.
 - 3. When work is completed, remove and dispose of surplus material including stumps, trees and brush, and leave premises in a condition acceptable to the DNR Construction Inspector.

3.14 FINISH GRADING:

- A. After completion of rough grading, scarify areas to receive topsoil to finish grade shown.
- B. Deposit topsoil to a minimum depth of 6". In areas with existing topsoil, no additional topsoil is required.
- C. Grade topsoil to eliminate water pockets or irregularities.
- D. Eliminate soil lumps and round abrupt changes in slope.
- E. Spread excess earth on site as directed by DNR Construction Inspector.

3.15 SITE RESTORATION:

- A. All disturbed areas within the boundaries of this project not specifically receiving a finished surface are to be seeded in accordance with Section 02930.
- B. Prepare all surfaces to receive seeding per "Standard Specifications" 2001 I.D.O.T., Section 2601.04.

END OF SECTION 02200

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes: The work covered by this Section consists of furnishing all material, labor and equipment necessary or required to do the trenching, backfilling and compacting needed for the proper and complete installation of underground utilities as shown on the Drawings.
- B. Related Sections: Drawings and General Provisions of the contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements.

Section 02785 - Electric Power Transmission

1.02 QUALITY ASSURANCE:

- A. Qualifications: Use adequate numbers of skilled workers 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. Codes and Standards: Perform all work of this Section in compliance with applicable requirements of governing authorities having jurisdiction.
 - 1. In addition to complying with the pertinent codes and regulations of other governing agencies, comply with applicable requirements of Iowa Department of Natural Resources Authorized Technical Specifications for Water and Sewer Projects, latest edition.
- D. Safety: All trenching, excavating and methods of construction shall conform to the state of Iowa Bureau of Labor and all OSHA standards.
- E. Where conflicts arise between Contract Documents and Referenced Codes and Standards, the latter shall prevail, unless Contract Documents are more stringent.
 - 1. Bring all conflicts to the attention of the DNR Construction Inspector.

1.03 PROJECT/SITE CONDITIONS:

- A. Environmental Requirements:
 - 1. Protect existing trees and other vegetation indicated or as directed by DNR Construction Inspector to remain in place, against unnecessary cutting, breaking or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling

construction materials or excavated materials within drip line, excess foot traffic or vehicular traffic, or parking of vehicles within drip line.

2. Provide temporary guards to protect trees and vegetation to be left standing.
3. Repair or replace trees and vegetation indicated to remain which are damaged by construction operations, in a manner acceptable to the DNR Construction Inspector.

B. Existing Conditions:

1. Site information indicated on the Drawings regarding existing conditions, is of a general nature.
 - a. Visit the site and become familiar with existing conditions.
2. Observe weather conditions.
 - a. Attempt no work in frozen conditions without the approval of the DNR Construction Inspector.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Fill and Backfill Materials:

1. Provide soil materials free from organic matter and deleterious substances, containing no rocks or lumps over 6" in greatest dimension, and with not more than 15 percent of the rocks or lumps larger than 2-3/8" in their greatest dimension.
2. Fill material is subject to the approval of the DNR Construction Inspector, and is that material removed from excavations or imported from off-site borrow areas, predominantly granular, nonexpansive soil free from roots and other deleterious matter.
3. Do not permit rocks having a dimension greater than 1" in the upper 12" of fill.
4. Cohesionless Material Used for Backfill: Provide sand free from organic material and other foreign matter, and approved by the DNR Construction Inspector.

B. Provide other materials, not specifically described but required for a complete and proper installation, selected by the Contractor subject to the approval of the Project Engineer.

PART 3 - EXECUTION

3.01 PREPARATION:

A. Protection of Persons and Property:

1. Barricade open holes and depressions occurring as part of the work, and post warning lights on property adjacent to or with public access.
2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, washout, and other hazards created by operations under this Section.

B. Protection of Utilities:

1. Unless shown to be removed, protect active utility lines shown on the Drawings or otherwise made known to the Contractor prior to trenching.
 - a. If damaged, repair or replace at no additional cost to the Owner.
2. If active utility lines are encountered, and are not shown on the Drawings or otherwise made known to the Contractor, promptly take necessary steps to assure that service is not interrupted.
3. If service is interrupted as a result of work under this Section, immediately restore service by repairing the damaged utility at no additional cost to the Owner.
4. If existing utilities are found to interfere with the permanent facilities being constructed under this Section, immediately notify the Project Engineer and secure instructions.
5. Do not proceed with permanent relocation of utilities until written instructions are received from the Project Engineer.

C. Dewatering:

1. Remove all water, including rain water, encountered during trench and sub-structure work to an approved location by pumps, drains, and other approved methods.
2. Keep trenches and site construction area free from water.

D. Dust Control: Use means necessary to prevent dust becoming a nuisance to the public, at neighbors, and to other work being performed on or near the site.

E. Maintain access to adjacent areas at all times.

3.02 TRENCHING:

- A. Provide sheeting and shoring necessary for protection of the work and for the safety of personnel.
1. Prior to backfilling, remove all sheeting.
 2. Do not permit sheeting to remain in the trenches except when, in the opinion of the DNR Construction Inspector, field conditions or the type of sheeting or methods of

construction such as use of concrete bedding are such as to make removal of sheeting impracticable.

- a. In such cases, the Project Engineer, upon recommendation from the DNR Construction Inspector, may permit portions of sheeting to be cut off and remain in the trench.

B. Open Cut:

1. Excavate for utilities by open cut.
2. If conditions at the site prevent such open cut, and if approved by the Project Engineer, trenching may be used.
3. Short sections of a trench may be tunneled if, in the opinion of the Project Engineer, the conductor can be installed safely and backfill can be compacted properly into such tunnel.
4. Where it becomes necessary to excavate beyond the limits of normal excavation lines in order to remove boulders or other interfering objects, backfill the voids remaining after removal of the objects as directed by the DNR Construction Inspector.
5. When the void is below the subgrade for the utility bedding, use suitable earth materials and compact to the relative density directed by the DNR Construction Inspector, but in no case less than 90 percent.
6. When the void is in the side of the utility trench or open cut, use suitable earth or sand compacted or consolidated as approved by the DNR Construction Inspector, but in no case to a relative density less than 80 percent.
7. Remove boulders and other interfering objects, and backfill voids left by such removals, at no additional cost to the Owner.
8. Excavating for appurtenances:
 - a. Excavate for manholes and similar structures to a distance sufficient to leave at least 12" clear between outer surfaces and the embankment or shoring that may be used to hold and protect the banks.
 - b. Overdepth excavation below such appurtenances, unless directed, will be considered unauthorized.
 - c. Fill unauthorized overdepth excavation with sand, gravel, or lean concrete as directed by the DNR Construction Inspector, and at no additional cost to the Owner.

C. Trench to the minimum width allowed for proper installation of the utility, with sides as nearly vertical as possible.

1. Accurately grade the bottom to provide uniform bearing for the utility.

D. Depressions:

1. Dig bell holes and depressions for joints after the trench has been graded.
 - a. Provide uniform bearing for the pipe on prepared bottom of the trench.
2. Except where rock is encountered, do not excavate below the depth indicated or specified.
3. Where rock is encountered, excavate rock to a minimum overdepth of 4" below the trench depth indicated.

E. Where utility runs traverse public property or are subject to governmental or utility company jurisdiction, provide depth, bedding, cover, and other requirements as set forth by legally constituted authority having jurisdiction, but in no case less than the depth shown in the Contract Documents.

F. Where trenching occurs in existing lawns, remove turf in sections, keep damp and replace turf upon completion of the backfilling.

G. Cover:

1. Provide minimum trench depth indicated below to maintain a minimum cover over the top of the installed item below the finish grade or subgrade:
 - a. Areas subject to vehicular traffic:

(1) Sanitary sewers:	48"
(2) Storm drains:	36"
 - b. Areas not subject to vehicular traffic:

(1) Sanitary sewers:	30"
(2) Storm drains:	18"
 - c. All areas:

(1) Water lines:	60"
(2) Natural gas lines:	24"
(3) Primary electrical cables:	42"
(4) Secondary electrical ducts:	36"
 - d. Concrete encased:

(1) Pipe sleeves for water and gas lines:	24"
(2) Sanitary sewers and storm drains:	12"

(3) Electrical ducts: 24"

2. Where utilities are under a concrete structure slab or pavement, the minimum depth need only be sufficient to completely encase the conduit or pipe sleeve, and electrical long-radius rigid metal conduit riser, provided it will not interfere with the structural integrity of the slab or pavement.
3. Where the minimum cover is not provided, encase the pipes in concrete as indicated.
 - a. Provide concrete with a minimum 28-day compressive strength of 3,000 psi.

3.03 BEDDING:

- A. Provide bedding as indicated on the Drawings and as specified herein.

3.04 BACKFILLING:

A. General:

1. Do not completely backfill trenches until required pressure and leakage tests have been performed, and until the utilities systems as installed conform to the requirements specified in the pertinent Section of these Specifications.
2. Except as otherwise specified, or directed for special conditions, backfill trenches to the ground surface with selected material approved by the DNR Construction Inspector.
3. Re-open trenches which have been improperly backfilled, to a depth as required for proper compaction.
4. Refill and compact as specified, or otherwise correct to the approval of the DNR Construction Inspector.
5. Do not allow or cause any of the work performed or installed to be covered up or enclosed by work of this Section prior to required inspections, test, and approvals.
6. Should any of the work be so enclosed or covered up before it has been approved, uncover all such work and, after approvals have been made, refill and compact as specified, all at no additional cost to the Owner.

B. Lower Portion of Trench:

1. Deposit approved backfill and bedding material in layers of 6" maximum thickness, and compact with suitable tampers of the density of the adjacent soil, or grade as specified herein, until there is a cover of not less than 14" over sewers and 12" over other utility lines.
2. Take special care in backfilling and bedding operations not to damage pipe and pipe coatings.

C. Remainder of Trench:

1. Except for special materials for pavements, backfill the remainder of the trench with material free from stones larger than 6" or 1/2 the layered thickness, whichever is smaller, in any dimension.
 2. Deposit backfill material in layers not exceeding the thickness specified, and compact each layer to the minimum density directed by the DNR Construction Inspector.
- D. Adjacent to Buildings: Mechanically compact backfill within ten feet of buildings.
- E. Consolidation of backfill by jetting with water may be permitted, when specifically approved by the DNR Construction Inspector, in areas other than building and pavement areas.

3.05 PIPE JACKING:

- A. Unless so or otherwise required, the Contractor may, at his option, install steel pipe casings, tongue-and-groove reinforced concrete pipes, and steel pipes under existing roads or pavements by jacking into place using procedures approved by the governmental agencies having jurisdiction and approved by the DNR Construction Inspector.

3.06 TUNNELING OPERATIONS:

- A. Unless so or otherwise required, the Contractor is allowed the option to tunnel pipes into position using procedures approved by the Project Engineer/DNR Construction Inspector and the governmental agencies having jurisdiction.

3.07 FIELD QUALITY CONTROL:

- A. Tests: Test for displacement of sewer and storm drains.
1. Check sewers and storm drains to determine whether displacement has occurred after the trench has been backfilled to above the pipe and has been compacted as specified.
 2. Flash a light between manholes or, if the manholes have not yet been constructed, between the locations of the manholes, by means of a flashlight or by reflecting sunlight with a mirror.
 3. If the illuminated interior of the pipeline shows poor alignment, displaced pipes, or other defects, correct the defects to the specified conditions and at no additional cost to the Owner.
- B. Inspection: The DNR Construction Inspector will inspect and approve open cuts and trenches before installation of utilities, and the following:
1. Assure that trenches are not backfilled until all tests have been completed.
 2. Check backfilling for proper layer thickness and compaction.
 3. Verify that test results conform to the specified requirements, and that sufficient tests are performed.
 4. Assure that defective work is removed and properly replaced.

END OF SECTION 02220

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes: The work consists of furnishing all labor, material and equipment for the construction of a toe drain for the drainage blanket and of drain pipes for porous backfill related to structures, as described herein, as indicated on the Drawings and as required for the construction of all work of this contract.
- D. Related Sections: Drawings and General Provisions of the Contracts, including the General Covenants and Provisions, Supplementary Covenant and Provisions and General Requirements, as well as, but not necessarily limited to, the following:

Section 02200 Earthwork
- C. Measurement Procedures: Subdrains will not be measured for payment, but are to be considered incidental to each related structure installed.
- F. Payment Procedures: Subdrains will not be paid for separately, but will be considered incidental to each related structure installed.

1.02 REFERENCES:

- A. Standards of Material and construction: Conform with the Standard Specification for Highway and Bridges Construction, latest edition of the Iowa Department of Transportation.
- B. Safety: Conform with the requirements of the State of Iowa Bureau of Labor and all OSHA standards.
- C. Codes and Standards: Comply with the provisions of the following codes, specifications and standards except where more stringent requirements are shown or specified.
 - 1. American Society for Testing of Material (ASTM):
 - 2. Federal Specifications (FS):
 - 3. Uniform Building Code, (UBC) Latest edition.
 - 4. Iowa State Building Code, latest edition
 - 5. Underwriters Laboratories.
- C. Where conflicts arise between the Drawings and Code Requirements, the latter shall prevail, unless the Drawings are more stringent.
 - 1. Bring conflicts to the attention of the Project Engineer/DNR Construction Inspector.

1.05 SUBMITTALS:

- A. Provide submittals in accordance with Section 01300.
- B. Product Data: Submit full information on all materials proposed for use in the work of this section, prior to procurement of said material, for Project Engineer's review.
 - 1. Materials list of items proposed to be provided under this section.
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
 - 3. Do not purchase or install material until approved by the Project Engineer.
- C. Shop Drawings: Submit shop drawings for fabrication and erection. Include plans, elevation, details of sections and connections. Show anchorage and accessory items. Provide templates for anchors and bolt installations.
 - 1. Review shop drawings requirements with DNR Construction Inspector before ordering shop drawings.
- D. Samples: Submit, for verification purposes, samples of each type of material, to be used in the work of this section, requested by the Project Engineer.
 - 1. Include in each set of samples the full range of color and texture to be expected in the completed work.
- E. Quality Control Submittals:
 - 1. Design Data: Submit design data.
 - a. Where materials or fabrications are indicated to comply with certain requirements or for design loading, include structural computation, material properties and other information needed for structural and analysis.
 - 2. Test Reports: Employ, at Contractor's expense, a testing laboratory acceptable to the Project Engineer to perform material evaluation tests and submit reports.
 - 3. Certificates: Provide materials certificates in lieu of materials laboratory test reports when permitted by Project Engineer.
 - a. Material certificates shall be signed by Manufacturer and Contractor certifying that each material item complies with or exceeds specified requirements.
 - 4. Manufacturer's recommended installation procedures which when approved by the Project Engineer, will become the basis for accepting or rejecting actual installation procedures used on the work.

1.06 QUALITY ASSURANCE:

- A. Qualifications: Use adequate numbers of skilled workers 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 in this Section.

1.08 PROJECT CONDITIONS OR SITE CONDITIONS:

- A. Environmental Requirements:
 - 1. Observe weather conditions.
 - 2. Do not attempt any work in frozen conditions without written approval from the DNR Construction Inspector.
- B. Existing Conditions: View job conditions prior to commencing work.
 - 1. Report any discrepancies between existing conditions, the specifications, and the Drawings to the attention of the Project Engineer/DNR Construction Inspector.
 - 2. Connect to existing facilities in accordance to the obvious intent of Contract Documents.
 - 3. Claims for extra payments as a result of failure to examine existing conditions will not be allowed.
- C. Field Measurements: Take field measurements prior to the preparation of shop drawings and fabrication whenever possible.
 - 1. Do not delay job progress.
 - 2. Allow for trimming and fitting where taking of field measurements before fabrication may delay work progress.

1.09 SEQUENCING:

- A. Properly coordinate the work of this section with all other trades.

PART 2 - PRODUCTS

2.03 MATERIALS:

- A. Subdrain pipe and joints: Polyvinyl chloride, single wall with smooth interior surface.
 - 1. Perforated pipe: Provide pipe perforated by the manufacturer in accordance with ASTM F 949.
 - a. Perforations: Accordance with AASHTO M252 specification.
 - 2. Nonperforated pipe: Provide nonperforated pipe meeting material specification to be used as indicated on the Drawings.

- B. Subdrain and toe drain pipes and fittings: Class 12454-B virgin PVC resin as defined in ASTM D1784.
 - 1. Class V RCP meeting the requirements of Section 02612 may be used in lieu of nonperforated PVC pipe for toe drain outlets.
- B. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Project Engineer.

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. Site Verification of Conditions: Examine the areas and conditions under which work of this Section will be performed.
 - 1. Correct conditions detrimental to timely and proper completion of the Work.
 - 2. Do not proceed until unsatisfactory conditions are corrected.

3.01 INSTALLATION OF SUBDRAIN PIPE

- A. Sheeting, Bracing and Shoring:
 - 1. Whenever necessary to prevent caving during excavation and protect adjacent structures, property, workers, and public; excavations shall be adequately sheeted, braced, and/or shored.
 - 2. Sheeting, shoring, and bracing shall conform to safety requirements of federal, state or local public agency having jurisdiction over such matters. Most stringent of these requirements shall apply.
 - 3. Sheeting, shoring, and bracing shall not affect structural integrity of new construction, watertightness or waterproofing of new construction, and shall allow for sufficient clearances necessary to install associated appurtenances adjacent to new construction. Sheeting, shoring, and bracing, shall not penetrate walls or slabs of new construction unless approved by OWNER.
 - 4. When close sheeting is required, drive to prevent soil from entering excavation either below or through sheeting.
 - 5. Sheeting shall be kept in place until structure has been placed and tested.
 - 6. Sheeting, bracing, and shoring shall be removed in manner not damaging structure or permitting voids within backfill.
 - 7. Fill settled areas remaining after sheeting has been pulled with sand or other approved material.

8. Type, design, detail, and installation of shoring, sheeting, and bracing shall be determined by and be the sole responsibility of CONTRACTOR.
9. Sheeting, shoring and bracing shall be designed by a Professional Engineer registered in the State of Iowa.

B. Dewatering:

1. CONTRACTOR shall be responsible for choosing method of ground water control.
2. If CONTRACTOR chooses to use deep wells or wellpoints, wells and wellpoints shall be designed, installed, and operated to prevent removal of in-situ materials.
3. Keep construction site free draining.
4. Keep excavations free from water.
5. Maintain groundwater minimum of 24 in. below excavations.
6. Remove soil disturbed by pressure or flow of groundwater and replace with granular bedding as directed by the ENGINEER.
7. Maintain dewatering systems in manner to prevent uplifting of and damage to structures during construction operations until construction is complete.
8. Protect adjacent utilities, structures, and properties from damage resulting from dewatering operations.
9. Dewatering wells shall be drilled, maintained, and abandoned in accordance with federal, state, and local ordinances.
10. Monitor integrity of nearby structures prior to, during and after construction is complete.
11. Discharge point shall be approved by OWNER.

C. Excavation:

1. Excavate to elevations and dimensions necessary to complete construction. Method of excavation shall be consistent with soil types encountered and result in undisturbed foundation subgrade. Loosened soils shall be recompacted.
2. Trenching Tolerances:
 - a. Excavate so pipes can be laid straight at uniform grade, without sags or humps, between elevations shown on drawings.
 - b. Where trench width for that portion of trench depth between trench bottom and outside top of pipe barrel, for any reason within CONTRACTOR'S

control, exceeds limits specified, CONTRACTOR, at his expense, shall furnish pipe with strength adequate for actual trench width.

c. CONTRACTOR'S trench slopes shall not result in the undermining of existing facilities located along the project area. If existing facilities are disturbed, it shall be CONTRACTOR'S responsibility to replace them at no cost to the OWNER unless specifically specified elsewhere.

3. All trenches shall be backfilled immediately after the pipe has been properly laid, jointed and the alignment checked by the DNR Construction Inspector.
4. Do not excavate for manholes and other structures until scheduled for construction.
5. Do not excavate within influence zone of existing footings or foundations without prior approval of OWNER.

D. Pipe Installation:

1. Lay pipes to the locations (lines and grades) shown on the Plans.
2. Lay pipes in conjunction with sand drainage blanket or porous backfill construction.
3. Begin laying pipe from lowest point in proposed pipe line where possible.
4. Lay pipe with bell end of bell and spigot pipe pointing up-grade where possible.
5. Lay pipe uniformly to line and grade so finished subdrain will present uniform bore.
 - a. Continuously monitor line and grade of pipe, and in event they do not meet specified limits described hereinafter, stop work immediately, notify Engineer and remedy cause before proceeding with work.
6. Retain pipe in position to maintain alignment and joint closure until backfill is completed to hold pipe in place. Lay pipe to conform to prescribed line and grade shown on drawings with limits as follows:
 - a. Variance from established line and grade shall not be greater than 1/32 in./in. of pipe dia. and not to exceed maximum of 1/2 in., provided any such variation does not result in level or reverse sloping invert; provided also, variation in invert elevation between adjoining end of pipe, due to nonconcentricity of joining surface and pipe interior surfaces, does not exceed 1/64 in. /in. of pipe dia., or 1/2 in. maximum.

E. If Class V RCP used for toe drain outlet, installation shall be in accordance with Section 02612.

F. Laying of Pipe in Cold Weather:

- 1 Project Engineer reserves right to order pipe laying discontinued whenever there is danger of quality of work being impaired because of cold weather.
2. Do not lay pipe on frozen ground.
3. Pipes with rubber gaskets or resilient-type joints: Warm gasket or joint material to facilitate making proper joint.

G. Fill Placement:

1. It is intended that ¾" gravel be used for backfill material, unless otherwise noted on the Plans.
2. Fill material shall be of such consistency and moisture content as may be effectively compacted to the specified density.
3. If the excavated material is too wet to obtain the required degree of compaction, the CONTRACTOR, at no additional cost to the CONTRACTING AUTHORITY, shall spread and work the material to reduce the moisture content.
4. Fill placement shall be in 6-in. lifts and mechanically compacted. Compaction shall be to not less than 95 percent Standard Proctor Density.
5. Fill placement shall extend to proposed excavated lines and slopes for project.

H. Excess Material:

1. Excess material shall be disposed of by CONTRACTOR at sites provided by the OWNER.

3.02 FIELD QUALITY CONTROL

- A. Noticeable variations from true alignment and grade will be considered sufficient cause for rejection of work.
- B. Individual pipe sections shall be subject to rejection for failure to conform to requirements of specifications or for following reasons:
 1. Cracks, sufficient to impair strength, durability, or serviceability of pipe.
 2. Defects indicating improper proportioning, mixing, and molding.
 3. Variations of more than 1/8 in./lin foot in alignment of pipe intended to be straight.
 4. Damaged ends, where such damage would prevent making satisfactory joint.

END OF SECTION 02411

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes: The work covered by this section consist of furnishing all materials, labor, and equipment necessary or required to do the grading, placing, and compacting of fill materials and surfacing parking areas, roads, and sidewalks as shown on the Drawings and as specified herein.
- B. Related Sections: Drawings and General Provisions of the contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements as well as, but not limited to, the following:
- Section 01400 - Quality Control
 - Section 02200 - Earthwork
 - Section 03100 - Concrete Form Work
 - Section 03200 - Concrete Reinforcement
 - Section 03300 - Cast-In-Place Concrete

1.02 REFERENCES:

- A. Standards of materials and construction shall conform with the Standard Specifications for Highway and Bridge Construction, 1997 Series of the Iowa Department of Transportation, including, but not necessarily limited to, the following:
- Section 1106 - Control of Material
 - Section 2111 - Granular Subbase
 - Section 2301 - Portland Cement Concrete Pavement
 - Section 2304 - Asphalt Cement Concrete Mixtures
 - Section 2511 - Removal and Construction of Portland Cement Concrete Sidewalks
 - Section 2512 - Portland Cement Concrete Curb Gutter
 - Section 4109 - Aggregate Gradation
 - Section 4115 - Coarse Aggregate for Concrete
 - Section 4120 - Granular Surfacing Material
 - Section 4121 - Granular Subbase Material
- B. AASHTO "Standard Specifications for Transportation, Material and Methods of Sampling and Testing".

C. American National Standard Institute (ANSI)

1. ANSI A117.1 - Specifications for making buildings and facilities accessible to, and usable by, physically handicapped people.

1.03 SUBMITTALS:

- A. Provide submittals in accordance with section 01300 as required in section 03300.

1.04 QUALITY ASSURANCE:

A. Qualifications:

1. Provide at least one person, on site, thoroughly familiar with the specified requirements, completely trained, and experienced in the necessary skills, to direct all work performed under this section.
2. Use adequate numbers of skilled workers to ensure construction in strict accordance with the approved design.

1.05 DELIVERY, STORAGE, AND HANDLING:

- A. General: Use only materials as specified for this section and tested and approved for use by the DNR Construction Inspector in accordance with the applicable portions of 1997 Series, I.D.O.T. Section 1106.

- B. Samples and Tests: Submit samples of materials to be used to the DNR Construction Inspector in advance of anticipated use to avoid construction delays.

1. Test and inspect and obtain approval of the DNR for each consignment of material before it is incorporated in the work.
2. Unless otherwise designated elsewhere provide samples, and tests, and apply a basis for acceptance in accordance with the current AASHTO "Standard Specifications for Transportation, Material and Methods of Sampling and Testing" including published interim standards.

- C. Field Testing: Testing of materials and workmanship will continue throughout the project as conducted by the DNR Construction Inspector.

1. Cooperate in these tests in any way needed to obtain the required data and samples.

- D. Unacceptable Materials: Unacceptable materials will be rejected as follows:

1. The DNR field inspector will consider unacceptable and reject any material not conforming to the specified requirements.
2. The DNR Inspector will also reject previously accepted material, delivered to the site, which have become damaged before actual incorporation into the work.
3. Promptly remove from the site all rejected material.

4. Unless otherwise authorized by the project Engineer, do not incorporate corrected rejected material into the work.

1.06 PROJECT/SITE CONDITIONS:

A. Environmental Requirements:

1. Observe weather conditions.
2. Attempt no work in frozen conditions without written approval from the DNR Construction Inspector.

B. Existing Conditions:

1. Survey job conditions prior to commencing work.
2. Bring any discrepancies of existing work with the Drawings and Specifications to the attention of the Architect/DNR Construction Inspector.

C. If paving work cannot be completed because of weather conditions, then place base course and delay wearing course to be placed when directed by the DNR Construction Inspector.

1. Fill any ruts, depression, washouts, etc. in the base course and bring to grade prior to placing wearing course as directed by the DNR Construction Inspector.

PART 2 - PRODUCTS

2.01 GRANULAR DRAINAGE MATERIAL:

- A. Provide granular drainage fill material for use under all concrete walks on grade, or exterior concrete slabs, or where shown on drawings in accordance with Section 02200.

2.02 CRUSHED ROCK TOP COURSE:

A. Provide crushed rock top course conforming to 1997 Series, I.D.O.T. Section 4120 as Class B Gravel, and with section 4109 for a No. 10 gradation, as defined below.

1. Class B gravel: A natural gravel or mixture of sand with gravel or crushed stone or both meeting the following requirements:

<u>Sieve Size</u>	<u>% Passing</u>
3/4	100
No. 4	50-80
No. 8	25-70

10% max. shale particles retained in No. 4 sieve.

15% max. mud balls and particles passing No. 200 sieve.

20% max. of combined shale or mud balls.

2.03 CRUSHED ROCK BASE COURSE:

A. Provide crushed rock base course in accordance with 1997 Series, I.D.O.T. Section 4121, and section 4109 for a No. 12 gradation, as described below.

1. Granular Subbase Material for Portland Cement Concrete: Sand, gravel or crushed stone particles, or uniform combination of these materials meeting the following requirements:

<u>Sieve Size</u>	<u>% Passing</u>
No. 1	100
No. 8	15-40
No. 200	0-6

a. Freeze-and-Thaw Loss: Less than 25% when tested with Laboratory Test Method 211, Method A.

b. Plasticity Index: No more than 5.

2.04 CONCRETE WALK AND SLAB MATERIALS:

A. Provide materials in accordance with Section 03300.

2.05 REINFORCING STEEL:

A. Provide reinforcing steel in accordance with Section 03200.

2.06 EXPANSION JOINT FILLER:

A. Provide expansion joint filler in accordance with Section 03300.

2.07 EXPANSION JOINT SEALER:

- A. Provide expansion joint sealer in accordance with Section 03300.

2.08 COARSE AGGREGATE FOR CONCRETE:

- A. Unless otherwise specified elsewhere and acceptable to the DNR Construction Inspector, provide Coarse Aggregate for Portland Cement Concrete Surfacing consisting of gravel or crushed stone particles in accordance with the requirements of IDOT Section 4115 and 4109 for a No. 4 graduation and a class 2 durability, as described below:

<u>Sieve Size</u>	<u>% Passing</u>
1 1/2	50-100
No. 4	0-10

2.09 CONCRETE MIX DESIGN:

- A. Air entrained, 4,000 PSI, compressive strength in accordance with Section 03300 with slump of two inches to four inches, and the following.
 - 1. Provide Class C-4 Concrete in accordance with I.D.O.T. Section 2301 and 2403, and current supplemental specification for the specified compressive strength above.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Preparation and correction of Subgrade: Conform to 1997 Series, I.D.O.T. Section 2111.
 - 1. Blade loose granular material present on the roadbed into windrow and store on the shoulder area, then correct the subgrade to required profile and cross section.
 - a. Wet and consolidate material moved in this operation so that the subgrade on which the next course is placed is smooth, firm, compacted earth.

2. Profile and Cross section requirements:
 - a. Check the cross section with an accurate template extending at least halfway across the width of the subgrade and correct deviations of more than one (1) inch from the template.
 - b. Remove dips or humps from profile to provide a good riding surface.
 - c. When PCC Pavement is to be placed on the subgrade, indicate surface with grade stakes and correct subgrade surface profile and cross section to within 0.05 foot of the desired elevation as indicated by the grade stakes.
 3. If unsuitable subgrade materials are encountered, remove this material to a depth as indicated by the DNR Construction Inspector and replace with suitable ballast material.
- B. Placing of Base Course: Place the base course in accordance with to applicable sections of the I.D.O.T. Standard Specifications for Granular Subbase, Standard Compaction as defined by the I.D.O.T. Standard Specifications.
- C. Placement of Granular Drainage Fill: Place granular drainage fill under all exterior concrete slabs, walks, drives, asphalt walks to a compacted minimum depth of six inches, or as indicated on the Drawings and in the details.
1. Compact to 95 percent maximum density as determined in accordance with ASTM Method D.
- D. Subgrade Preparation for Concrete Surfacing: Level and compact granular subbase.
1. Sprinkle with water, if dry, until subbase will no longer absorb moisture.
- E. Concrete Forms: Forms for concrete surfacing; wood or metal, staked so they are firmly held to line and grade.
1. Make upper edge of form level with finish grades.
 2. Do not use twisted, warped, or broken forms.
 3. Coat forms before placing concrete.
 4. Lap reinforcing mesh six inches.
 5. Leave forms in place 12 hours minimum unless directed otherwise.
- F. Concrete Walks and Aprons:
1. Concrete Surfacing: Construct exterior concrete walks and aprons where shown on the Drawings in accordance with the applicable portions of the I.D.O.T. Removal and Construction of Portland Cement Concrete Sidewalks, Section 2511.
 - a. Install expansion joints at transitions of walks in addition to those locations specified in I.D.O.T. Section 2511.

- b. Dowel exterior slabs into interior slabs as shown on the Drawings.
2. Concrete Placement: Do not place concrete over frozen subbase, or ice-coated forms.
 - a. Tamp and spade or vibrate concrete enough to compact firmly during placement.
3. Concrete:
 - a. Between 50 and 70 degrees Fahrenheit when placed.
 - b. In cold weather, heat materials to obtain required temperature.
 - c. In hot weather, a water-reducing retarder may be used, if approved by the Architect.
 - d. Erect tight and plump bulkheads, when stopping placement and forming construction joint.
 - c. Brush on new cement when pouring against hardened concrete.
4. Concrete sidewalks : 4" thick minimum
5. Expansion Joints: Install specified one-half inch (1/2") thick pre-molded expansion filler at abutting or intersecting construction and in expansion joints.
 - a. Set top of joint filler within one inch (1") of slab surface.
 - b. Hot pour joints to within one-fourth inch (1/4") of surface with specified joint sealer to full depth of slab.
6. Control Joints:
 - a. Score concrete with 1/4" x 1-1/4" deep control joints.
 - b. Use straightedge guide when scoring joints.
 - c. Where required depth of control joint cannot be made by scoring, cut joints with carborundum saw.
7. Finishing: Finish apron with fiber broom after leveling and floating. Tool expansion and control joint edges to one-fourth inch (1/4") radius.
8. Do not overwork concrete. Do not allow coarse aggregate to be visible in the final finish.
9. Protecting and Curing: Protect concrete surfaces from rapid drying or wash by rain.
 - a. Cure and seal immediately after finishing by applying two spray coats of membrane curing compound, in accordance with manufacturer's instructions, at the rate of 500 square feet, or less, per gallon, per coat.

- b. Unless otherwise directed by DNR Construction Inspector, do not open surfaced areas to traffic for seven (7) days after concrete placement.
- c. In cold weather, avoid opening surfaces where there is danger of de-icing salts from vehicles damaging concrete surface.

3.02 FIELD QUALITY CONTROL:

- A. Slump and Control Tests: Meet requirements of Section 03300 and I.D.O.T.
 - 1. Take one set of control test cylinders for every 20 cubic yards and minimum of one set of three cylinders for each day's pour.

3.03 CLEANING:

- A. Upon completion of construction, remove all excess materials and construction debris, and restore any damage done to existing buildings or landscape.

END OF SECTION 02510

PART 1 - GENERAL

1.01 SUMMARY:

A. Section Includes: The work covered by this section consist of furnishing all materials, labor, and equipment necessary or required to do the grading, placing and compacting of fill materials and surfacing, paving for roadways, parking area as shown on the Drawings and as specified herein.

B. Related Sections: Drawings and General Provisions of the contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements as well as, but not necessarily limited to, the following:

Section 02200 - Earthwork

C. Measurements and Payments:

1. Measure the quantity of material delivered in tons.

2. Weight on accurate scales designed for weighing loaded trucks.

3. Load vehicles to insure against loss of material between the scales and the point of delivery. No deductions will be made for the weight of moisture naturally occurring in the material. Material will not be deposited and spread until the scale weight ticket is delivered to the inspector and the weight of material verified.

4. The Contract Documents provide for payment of a lump sum bid amount for the entire project, part of which is the work of this contract.

a. The quantity of material provided will be verified by scale tickets and compared to the estimated quantity provided as part of the Contractor's Price Breakdown.

b. In the event that the estimated quantity is larger than the quantity provided, the Contractor shall pay the Owner a deduct for the difference in cost for both quantity and labor.

c. Additional payments for increased quantities or labor will only be allowed if a change order is warranted due to a change in project scope or for unforeseen situations, as determined by the Architect, warranting additional material and labor to accomplish the original work of this section.

c. The Owner will make no additional payments for additional material or labor to correct deficiencies, shortages or mistakes by the Contractor.

D. Basis of payment:

1. Include in the contract lump sum amount, a lump sum amount for the cost of the work of this section based on unit price per ton for the surfacing material which shall be full

compensation for furnishing all material, tools, equipment and labor necessary to complete the work of this section in conformance with the Drawings and Specifications.

2. This shall be full payment for furnishing, delivering, depositing and spreading the surfacing material as directed and approved by the DNR Construction Inspector.
3. The DNR Construction Inspector will:
 - a. Verify that all quantities are in accordance with requirements.
 - b. Calculate the value of deducts owed the Owner at the unit price provided in the Contractor's Price Breakdown.

1.02 REFERENCES:

- A. Standards of materials and construction shall conform to the Standard Specifications for Highway and Bridge Construction, Series of 1984 of the Iowa Department of Transportation.

1.03 SUBMITTALS:

- A. Provide submittals as required in section 01300

1.04 CONTROL OF MATERIALS:

- A. General: Use materials as specified in this section, tested and approved for use by the DNR Construction Inspector in accordance with the applicable portions of 2001 Series, I.D.O.T. Section 1106.
- B. Samples and Tests: Submit samples of materials to the DNR Construction Inspector in advance of the anticipated use to avoid construction delays. Submit samples and tests in accordance with 2001 Series, IDOT Section 1106.02.
- C. Field Testing: Testing of materials and workmanship will continue throughout the project as conducted by the DNR Construction Inspector. Cooperate in these tests in any way needed to obtain the required data and samples.
- D. Unacceptable Materials: Unacceptable materials will be rejected in accordance with 2001 Series, IDOT Section 1106.04.

1.05 JOB CONDITIONS:

- A. Survey job conditions prior to commencing work. Bring any discrepancies between existing work and the Drawings and Specifications to the attention of the Architect/DNR Construction Inspector.
- B. Observe weather conditions. Attempt no work in frozen conditions without written approval from the DNR Construction Inspector.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Provide crushed stone consisting of a uniform mixture of coarse and fine particles produced by crushing ledge rock, predominantly limestone, dolomite, or quartzite.
 - 1. Special Gradation: As described in the Plans and as directed by the DNR Construction Inspector.

PART 3 - EXECUTION

3.01 GENERAL:

- A. Accomplish the work of this section in accordance with the applicable portions of the 2001 Series, IDOT Standard Specification for Highway and Bridge Construction.

3.02 PREPARATION OF SUBGRADE:

- A. Conform to 2001 Series, IDOT Section 2111. If unsuitable subgrade materials are encountered, remove this material to a depth as indicated by the DNR Construction Inspector and replace with suitable ballast material.

3.03 PLACING OF CRUSHED STONE COURSE:

- A. Construct base course using crushed rock top course material as defined by 2001 Series, IDOT Section 4121. Place the base course in accordance with applicable sections of the IDOT Standard Specifications for Granular Subbase, Standard Compaction as defined by the IDOT Standard Specifications.

3.05 CLEAN UP:

- A. Upon completion of construction, remove all excess materials and construction debris, and restore any damage done to existing buildings or landscape.

END OF SECTION 02506

SECTION 02510
WALK, ROAD AND PARKING PAVING

PART 1 - GENERAL

1.01 SUMMARY:

A. Section Includes: The work covered by this section consists of furnishing all materials, labor, and equipment necessary or required to do the grading, placing, and compacting of fill materials and surfacing parking area and walk paving as shown on the Drawings and as specified herein.

B. Related Sections: Drawings and General Provisions of the contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements as well as, but not limited to, the following:

Section 03100 - Concrete Form Work
Section 03200 - Concrete Reinforcement
Section 03300 - Cast-In-Place Concrete

C. Measurement: Measure the quantity of material installed, to the nearest ton.

D. Method of Payment:

1. Contract Unit Price: When payment for the work of this section is so designated, the contractor will be paid the Contract Unit price per ton.

a. In the event that the estimated quantity is larger than the quantity provided, pay the Owner a deduct for the difference in cost for both quantity and labor.

b. Additional payments for increased quantities or labor will only be allowed if a change order is warranted due to a change in project scope or for unforeseen conditions, as determined by the Project Engineer, in accordance with the provisions of the General Conditions of the Contract.

3. The Owner will make no additional payments for additional material or labor to correct deficiencies, shortages, or mistakes by the Contractor.

1.02 REFERENCES:

A. Standards of materials and construction shall conform with the Standard Specifications for Highway and Bridge Construction, Series of 2001, of the Iowa Department of Transportation.

1.03 DELIVERY, STORAGE, AND HANDLING:

- A. General: Use only materials as specified for this section as tested and approved for use by the DNR Construction Inspector in accordance with the applicable portions of 2001 Series, I.D.O.T. Section 1106.
- B. Samples and Tests: Submit samples of materials to be used to the DNR Construction Inspector in advance of anticipated use to avoid construction delays. Submit samples and tests in accordance with 2001 Series, I.D.O.T. Section 1106.02.
- C. Field Testing: Testing of materials and workmanship will continue throughout the project as conducted by the DNR Construction Inspector. Cooperate in these tests in any way needed to obtain the required data and samples.
- D. Unacceptable Materials: Unacceptable materials will be rejected in accordance with 2001 Series, I.D.O.T. Section 1106.04.

1.04 PROJECT/SITE CONDITIONS:

- A. Environmental Requirements: Observe weather conditions. Attempt no work in frozen conditions without written approval from the DNR Construction Inspector.
- B. Existing Conditions: Review job conditions prior to commencing work. Bring any discrepancies of existing work with the Drawings and Specifications to the attention of the DNR Construction Inspector.
- C. If paving work cannot be completed because of weather conditions, then place base course and delay wearing course to be placed when directed by the DNR Construction Inspector. Fill any ruts, depressions, washouts, etc. in the base course and bring to grade prior to placing wearing course as directed by the DNR Construction Inspector.

PART 2 - PRODUCTS

2.01 ASPHALTIC CONCRETE PAVING MATERIAL:

- A. Provide materials in accordance with 2001 Series, I.D.O.T. Section 2203 and Section 2303.

2.02 CONCRETE WALK AND SLAB MATERIALS:

- A. Provide materials in accordance with Section 03300.

2.03 REINFORCING STEEL:

- A. Provide reinforcing steel in accordance with Section 03200.

2.04 EXPANSION JOINT FILLER:

- A. Provide expansion joint filler in accordance with Section 03300.

2.05 EXPANSION JOINT SEALER:

- A. Provide expansion joint sealer in accordance with Section 03300.

2.06 CONCRETE MIX DESIGN:

- A. Air entrained, 3,500 PSI, compressive strength as specified in Section 03300 with slump of two inches to four inches.

2.07 WHEEL STOPS:

- A. Provide precast concrete wheel stops or curb, 3500 psi, fully reinforced complete with suitable anchorage device as required for positive and permanent attachments to parking surfaces.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Preparation of Subgrade: Conform to 2001 Series, I.D.O.T. Section 2109. If unsuitable subgrade materials are encountered, remove this material to a depth as indicated by the DNR Construction Inspector and replace with suitable ballast material.
- B. Concrete Forms: Forms for concrete surfacing: wood or metal, staked so they are firmly held to line and grade. Make upper edge of form level with finish grades. Do not use twisted, warped, or broken forms. Coat forms before placing concrete. Lap reinforcing mesh six inches. Leave forms in place 12 hours minimum unless directed otherwise.
- C. Asphaltic Concrete and Paving:
 - 1. General: Plant mix asphaltic concrete in accordance with the material and placing method requirements of 2001 Series, IDOT Section 2303 for Type A and/or Type B Asphalt Cement Concrete.
 - 2. Asphaltic Concrete Paving: Use asphaltic concrete paving on all roadway, service and parking areas except those specifically designated as walkways.
 - 3. Design Mixes: Type "A" asphaltic concrete mixture size shall be 1/2", and Type "B" asphaltic concrete mixture size shall be 3/4". Contractor to submit asphalt

mix design to Project Engineer for approval prior to commencing work on the project.

- D. Installation of Wheel Barrier: Construct wheel barriers where shown on the Drawings. Units shall be set in one-half inch nominal cement grout. If modular units are used, install with open joints between blocks.
- E. Concrete Curbing: Place curbing where shown on the Drawings. Construct in accordance with I.D.O.T. Section 2512 Portland Cement Concrete Curb and Gutter. Coordinate efforts with those installing catch basins and curb inlets as shown on the Drawings.
- F. Concrete Walks and Aprons:
 - 1. Concrete Surfacing: Construct exterior concrete walks and aprons where shown on the Drawings. Construct in accordance with the applicable portions of the I.D.O.T. Portland Cement Concrete Sidewalks, Section 2511. Install expansion joints at transitions of walks and aprons in addition to those locations specified in I.D.O.T. Section 2511. Dowel drivable apron slabs into interior slabs as shown on the Drawings.
 - 2. Concrete Placement: Do not place concrete over frozen subbase, or ice-coated forms. Tamp and spade or vibrate concrete enough to compact firmly during placement.
 - 3. Concrete: Ambient air temperature shall be between 40 and 70 degrees Fahrenheit when placed. In cold weather, heat materials to obtain required temperature. In hot weather, a water-reducing retarder may be used, if approved by the Project Engineer. Erect tight and plumb bulkheads, when stopping placement and when forming construction joints. Brush on new cement when pouring against hardened concrete.
 - 4. Concrete Apron: 6" thick minimum.
 - 5. Expansion Joints: Install specified one-half inch (1/2") thick pre-molded expansion filler at abutting or intersecting construction and in expansion joints. Set top of joint filler within one inch (1") of slab surface. Hot pour joints to within one-fourth inch (1/4") of surface with specified joint sealer. Expansion joints shall be full slab depth.

6. Control Joints: Score concrete with 1/4" x 1-1/4" deep control joints. Use straightedge guide when scoring joints. Where required depth of control joint cannot be made by scoring, cut joints with carborundum saw.
 7. Finishing: Finish apron with fiber broom after leveling and floating. Tool expansion and control joint edges to one-fourth inch (1/4") radius.
 8. Do not overwork concrete. Do not allow coarse aggregate to be visible in the final finish.
 9. Protecting and Curing: Protect concrete surfaces from rapid drying or wash by rain. Cure and seal immediately after finishing by applying two spray coats of membrane curing compound, in accordance with manufacturer's instructions, at the rate of 500 square feet, or less, per gallon, per coat. Unless otherwise directed by DNR Construction Inspector, do not open surfaced areas to traffic for seven (7) days after concrete placement. In cold weather, avoid opening surfaces where there is danger of de-icing salts from vehicles damaging concrete surface.
- K. Parking Stall Lines: Paint parking stall and directional lines on roadway and parking areas on the paving surface with traffic signal and striping paint. Conform with manufacturer's specification and recommendations for surface cleaning and paint application. Color of pavement markings to be as shown on the Plans

3.02 FIELD QUALITY CONTROL:

- A. Slump and Control Tests: Meet requirements of Section 03300 and I.D.O.T. Take one set of control test cylinders for every 50 cubic yards and minimum of one set of three cylinders for each day's pour.

3.03 CLEANING:

- A. Upon completion of construction, remove all excess materials and construction debris, and restore any damage done to existing buildings or landscape.

END OF SECTION 02510

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section describes buried piping shown or specified and required for complete piping system.
- B. "Buried" refers to all piping and appurtenances buried beneath or buried outside buildings and structures.
- C. Related work specified elsewhere:
 - 1. Section 01000 – GENERAL REQUIREMENTS
 - 2. Section 01300 – SUBMITTALS
 - 3. Section 02220 – TRENCHING, BACKFILLING & COMPACTING
 - 4. Section 02930 – LAWNS AND GRASSES

1.02 REFERENCES:

- A. Safety: All methods of construction shall conform to the requirements of the State of Iowa Bureau of Labor and all OSHA standards.
- B. Codes and Standards: Comply with provisions of the following codes, specifications and standard except where more stringent requirements are shown or specified.

AASHTO - American Association of State Highway and Transportation Officials

ANSI - American National Standard Institute

ASME - American Society of Mechanical Engineers

ASTM - American Society of Testing Materials

AWWA - American Water Works Association

NBFU - National Bureau of Fire Underwriters

NEC - National Electrical Code

NEMA - National Electric Manufacturers Association

UL - Underwriters Laboratories, Inc.

Iowa Code - Applicable State of Iowa Administrative Code

UPC - Uniform Plumbing Code

- C. In addition to the above standards, conduct all the work of this Section in accordance with the latest edition of the Authorized Technical Specifications for Water and Sewer Projects of the Iowa Department of Natural Resources.
- D. Where conflicts arise between the Plans and Code Requirements, the latter shall prevail, unless plans are more stringent.
 - 1. Bring all conflicts to the attention of the Engineer and the DNR Construction Inspector.

1.03 SUBMITTALS

- A. Provide submittals in accordance with Section 01300.
- B. Include following information as minimum:
 - 1. Identify pipe service and material to be used for each.
 - 2. Proposed adapters between dissimilar pipe.
 - 3. Pipe material, wall thickness, class and/or schedule number.
 - 4. Laboratory tests for materials listed in Section 01010 - General Provisions.
- E. Product Data: Prior to procurement, submit for Engineer's review, full information on all materials proposed for use in the work of this section, and do not install any material until approved by the Engineer.
 - 1. Materials list of items proposed to be provided under this section.
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
- F. Shop Drawings: Review shop drawings requirements with DNR Construction Inspector before ordering shop drawings.
 - 1. Submit shop drawings for fabrication and erection.
 - 2. Include plans, elevation, details of sections and connections.
 - 3. Show anchorage and accessory items. Provide templates for anchor and bolt installation.
- G. Quality Control Submittals:
 - 1. Provide manufacturer certificates, laboratory or factory test reports.
 - 2. Material certificates, signed by Contractor and manufacturer shall certify that each material item complies with or exceeds specified requirements.
 - 3. Manufacturer's recommended installation procedures which, when approved by the Engineer, will become the basis for accepting or rejecting actual installation procedures used on the work.

1.04 PROJECT/SITE CONDITIONS:

- A. Survey conditions prior to commencing work. Bring any discrepancies of existing work with the Drawings and Specifications to the attention of the Project Engineer/DNR Construction Inspector.
 - 1. Verify sizes, dimensions, measurements, types and location of existing piping and appurtenances at points of connection.
 - 2. Conduct all field measurements necessary to determine pipe laying lengths so that pipe can be laid in place without forcing or springing.

3. Bring any discrepancies of existing work with the Drawings and Specifications to the attention of the Project Engineer/DNR Construction Inspector.
- B. Observe weather conditions. Attempt no work in frozen conditions without written approval from the DNR Construction Inspector.
 - C. Make connections to existing mechanical facilities in accordance with the obvious intent of Drawings and Specifications. Claims for extra payments as a result of failure to examine existing conditions at the site will not be accepted.
 - D. Claims for extra payments as a result of failure to examine existing conditions at the site will not be allowed.
 - E. Keep duration of water service interruptions to existing facilities as short as possible.
 - F. Field Measurements: Where possible, take field measurements prior to preparation of shop drawings and fabrication. Do not delay job progress; allow for trimming and fitting where taking field measurements before fabrication might delay work.

PART 2 - PRODUCTS

2.01 PIPE MATERIALS

- A. Pipe material, thickness, joints and fittings to conform with BURIED PIPE SPECIFICATION TABLE included hereinafter.
- B. Pipe material permissible for each type service to conform with BURIED PIPING SCHEDULE included hereinafter; where more than one pipe material is listed for particular service, Contractor select and furnish one pipe material for that service unless Engineer approves otherwise (galvanic action may occur if certain pipe materials are intermixed).
- C. Buried or exposed bolts, nuts and similar items: Cor-Blue T-bolt.
- D. Label intended use for every pipe length and fitting supplied for construction to eliminate misuse in field.

BURIED PIPE SPECIFICATION TABLE

<u>Pipe</u>	<u>Material</u>	<u>Thickness</u>	<u>Joints</u>	<u>Fittings</u>
Ductile Iron (DI)	ANSI A21.51 and AWWA C105. Coating, lining, polyethylene encasement as specified hereinafter.	Class 52	Mechanical or push-on per ANSI 21.11. Use retainer glands with set screws where restrained joints are shown on plans.	Mechanical or push-on per ANSI A21.10, 150 psi pressure ratings. Restrained joint listed by UL
Polyethylene (PE1)	ASTM F714	SDR 11 160 psi	Fusion weld; use MJ adapters for connection to DI pipe as specified hereinafter.	ASTM D3261
Polyethylene (PE2)	AWWA C906	SDR 11 160 psi	Fusion weld; use MJ adapters for connection to DI pipe as specified hereinafter.	ASTM D3261
Polyvinyl-chloride Pipe (gravity) (pvc-g)	ASTM D3034	SDR 23.5	Elastomeric gasket push-on joints	ASTM D3212

BURIED PIPING SCHEDULE

<u>Service</u>	<u>Materials</u>	<u>Valves</u>
Wastewater Force Main	PE1, DI	Plug
Water Main	PE2	Gate, corp. & curb stops
Lagoon Piping	DI	Plug
Sanitary Sewer	pvc-g	None

2.02 PIPE COATING AND LINING

- A. Coat outside of ductile iron pipe with standard coating.
- B. Cement mortar line all ductile iron pipe and fittings, ANSI A21.4; apply bituminous seal coat over cement lining. Coating shall be smooth, tough and tenacious, and impervious to water without any tendency to scale off.
- C. Polyethylene film: 8 mil thickness; black pigmentation; wrap DI pipe, as recommended by manufacturer; ANSI A21.5; Clow Corporation F-192, or equal; use for corrosion protection on all iron pipe, fittings and valves.
 - 1. Use flat tube width and polyethylene overlap recommended by manufacturer for various pipe diameters.
 - 2. Use 2" x 8 mil polyethylene adhesive tape with paper backing.

2. Anchoring Tees: Clow Corporation F-1217, or equal.
3. Anchoring Elbows: Clow Corporation F-1218, or equal.
4. Anchoring Pipe: Clow Corporation F-1216, or equal.
5. Retainer Glands: Clow Corporation F-1058, or equal.
6. Polyethylene/DI pipe adapter: Driscopipe Mechanical Joint Adapter, or equal.

B. Buried or exposed bolts, nuts and similar items: NSS Industries Cor-Blue T-bolt.

2.06 WALL SLEEVES

1. Use where shown for pipes passing through walls.
2. Materials: Cast iron with intermediate flange on piping 3" or larger; galvanized steel pipe with anchor ring or lugs on piping smaller than 3".
3. Sleeve length: Flush with surface.
4. Clearance: As recommended by seal manufacturer.
5. Seal: Mechanical, link-type, modular, field assembled, insulating, positive-sealing; "link-Seal" by Thunderline Corp., or equal.

2.07 MANHOLES

A. Conform to details on plans and Standard Drawings; use eccentric top except where noted on plans.

B. Diameter and thickness of base may be increased by Engineer due to poor foundation conditions.

C. Standard, special or shallow manholes:

1. Precast reinforced concrete manhole sections, except as shown otherwise; 48" inside diameter; ASTM C478, except use minimum wall thickness: 5"; one cage reinforcing, minimum reinforcement: 0.18 sq. in. per linear foot of wall cross section.
2. Joints: use rubber-ring-gasket type, flexible joint, O-ring gasket, or equal, conform with ASTM C443; apply heavy bitumastic coating at all joints on outside of barrel 12" wide around entire perimeter.
3. Secure frame and adjusting rings to upper manhole section to prevent movement or entry of water.
4. Drop connections: use for manholes where difference in elevation of connecting pipes is greater than 24".
5. Provide smooth, semi-circular invert, same size as outlet pipe, through manhole; make curve radius as large as practical for changes in flow direction; drain all water freely from manhole; slope floor 1/2"/ft. toward invert.

D. Portland Cement:

1. For concrete in manholes, comply with ASTM C150, type II.
2. For concrete in cradle and encasement: Type optional with the Contractor.

3. Concrete: Provide 3,000 psi concrete in accordance with pertinent provisions of Section 03300 of these Specifications.

4. Mortar: Comply with ASTM C270, type M.

E. Accessories:

1. Manhole Cover: Neenah Type "B", or equal.
2. Frames: Minimum clear opening 24", minimum weight for frame and lid 390 lbs. R1642 by Neenah or equal.
3. Steps: M.A. Industries PS-1-PF, or equal; copolymer polypropylene plastic; provide in all manholes spaced 16" oc; top step 10" below top of cone section; locate 90° from direction of flow.
4. Drill two 1" dia. holes in manhole frame flange to accommodate anchor bolts specified hereinafter.
5. Secure frame and adjusting rings to upper manhole section with 2-1/2" dia. anchor bolts, equally spaced on 2'-5" dia. circle to prevent movement of frame or entry of water; grout frame in place.
6. Provide concrete adjusting rings as necessary to place cover at grade or to required elevation; provide two adjusting rings minimum; maximum height of manhole adjustment using adjusting rings: 18"; secure to upper manhole section; make joints with bituminous jointing material to prevent entry of water.

F. Manhole bottoms:

1. If precast or poured without manhole section being embedded: place primed manhole section in bed of bituminous jointing material; pour non-shrinking concrete fillet around outside of manhole section.
2. If poured with manhole section embedded: embed 2" minimum.

G. Use flexible, watertight connection between pipe and manhole blockout; submit proposed detail to Engineer for review.

H. Frames and Covers: Unless otherwise shown on the Drawings, set frames and covers.

1. In paved areas: The top of the cover will be flush with the finished pavement.
2. In unpaved areas: The top of the cover will be 2" higher than finished grade.

2.08 VALVES IN GENERAL

A. Valve types to conform with Buried Piping Schedule contained hereinbefore and as shown on plans.

B. Use valves of single manufacturer for each pipe service insofar as possible.

C. Provide all special tools required for packing and disassembling valves.

D. Valves designed specifically for burial and service intended.

E. Mechanical or push-on joints for iron pipe per ANSI A21.11.

F. Provide adapters if required to join pipe and valves.

2.08 VALVE BOXES AND VALVE MANHOLES

- A. American Flow Control Trench Adapter, grey iron lid with stainless steel locking bolt, HDPE top, HDPE reducer coupling gland, self-centering alignment ring, 2" operating nut stem extension to grade level.
- B. Each lid shall be labeled SEWER or WATER as required.
- C. Provide and install valve box for each valve.
- D. Valve Manholes: 48" precast concentric manholes for reinforce concrete pipe in accordance with ASTM C -478 for all valves larger than 12" diameter or as shown on the drawings.
Frame and cover: 2'-6" diameter, Neenah R-1743 or equal.

2.09 PLUG VALVES

- A. Non-lubricated, eccentric-style plug valve: full open port area through valve not less than 100% pipe cross sectional area for 6" and smaller pipe; driptight shutoff in both directions at full rated pressure; use mechanical joint connections.
- B. Install valve with seat on outlet side; install valve stems in vertical position for valves 4" and smaller; for valves 6" and larger install with plug rotating up in open position. Provide geared actuator, suitable for buried service, for valves 6" and larger.
- C. Provide 2" operating nut and T operator of sufficient length to operate valves from ground surface for buried piping.
- D. Minimum design cold water working pressure: 175 psi per ANSI B16.1.
- E. Pressure test all valves in shop; minimum 350 psi hydrostatic water test pressure; reject defective valves; provide certified test results stating valves furnished did not leak under test conditions.
- F. Manufacturer: ValMatic, DeZurik or equal.

2.10 GATE VALVES

- A. Conform to AWWA C509, iron body, resilient wedge type, non-rising stem, O-ring seals, 200 psi working pressure, open left, mechanical joints, epoxy coated; RW Waterous Series 500, American Flow Control Series 2500, Clow F-6100 and F-6110, Mueller Company A2370-20.
- B. Install valves in accordance with directions of manufacturer.

2.11 AIR RELEASE VALVES:

- A. Provide shop tested, air release valves with a working pressure of 150 psi, as shown. Clow F-3076, APCO No. 400 or approved equal.

2.12 HYDRANTS

A) Yard Hydrants

- a) Freezeless post type yard hydrant: 1" pipe inlet; one 3/4" brass hose thread outlet; backflow preventer; set inlet 5-1/2' below grade; non-freezing with positive automatic drain. Provide copper elbow at base for support.
- b) Woodford Iowa Model Y2.

B) Flushing Hydrants

- a) Anti-freezing Kupferle Model No. 77 blow-off hydrant or approved equal, with 2" FIP side inlet. The hydrant outlet shall be sized and of a configuration to prevent the attachment of fire hoses.
- b) Provide lower hydrant barrel length suitable for six feet of trench depth.
- c) Furnish two (2) operating wrenches for each project

2.13 SERVICE CONNECTIONS

- A. Corporation stops: ball-type, coated ball and resilient seats, inlet AWWA threaded; outlet: copper-tubing sized, flare or compression for copper, compression or pack joint type for plastic with stainless steel liner for plastic pipe; Hayes 5200, Mueller H-15000, Ford B600, A.Y. McDonald 4701, or equal.

B. Curb Stops

- a) Curb Stops with Drain: Mueller M -15210, Ford 222 -SW, A.Y. McDonald 4714, or approved equal.
- b) Curb Stops without Drain: Mueller M- 15200, or approved equal.
- c) Curb box: extension type curb box with arch pattern base, cast iron base and lid.

2.14 SERVICE SADDLES:

- A. Rockwell, Mueller Company, A.Y. McDonald or approved equal.

2.15 SERVICE BOXES:

- A. Mueller H- 10306, A.Y. McDonald 5601, Ford EA1-50-40-45R, or approved equal.

2.16 SERVICE CONNECTIONS FOR GRAVITY SEWER:

- A. Provide service connections where indicated on the drawings or as required for a complete and proper installation.
- B. Use wye or tee branch where invert of sewer is less than ten feet below ground surface.
 1. Rotate branch 30° minimum from vertical.
- C. Use tee branch and riser pipe where invert of sewer is 12' or more below ground surface.

1. Extend riser up to 10' below ground surface.
- D. When conditions are such that connection pipe cannot be supported adequately on undisturbed soil or compacted fill, engage the pipe in concrete backfill, or support on a concrete cradle.
1. Provide concrete required because of conditions resulting from faulty construction methods or negligence, at no additive cost to the Owner.

2.16 TRACER WIRE

- A. Tracer wire: #12 THHN or TWHN copper wire.
- B. Splice kits: 3M - Scotchcast No. 3832, or equal.
- C. Ground rods:
1. Provide uniform covering of electrolytic copper metallically bonded to steel rod.
 2. Minimum diameter: 3/8".
 3. Minimum length: 60".
 4. Blackburn Catalog #3755 or equal.
- D. Ground rod clamp: corrosion- resistant copper alloy ground rod clamp; Blackburn Catalog #G3 or equal.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION

- A. Protect pipe joints and valves from injury while handling and storing.
- B. Use no deformed, defective, gouged or otherwise impaired pipe joints or valves.
- C. Clean bell and spigot surfaces of dirt and foreign matter before jointing pipe.
- D. Make joints in strict accordance with manufacturers recommendations.
- E. Rap and blow out piping and valves before and after installation.
- F. Provide flexible joint at connection to all structures or provide pipe joint within 2' of outside face of structure for differential settlement; provide details to Engineer for review.
- G. See Section 02220 - Sitework for trench excavation and backfill.

3.02 GRAVITY PIPE INSTALLATION

- A. Before laying pipe, verify all measurements at site; make necessary field measurements to accurately determine make-up lengths or closures.
- B. Begin at lowest point in line; lay bell or groove ends pointing upstream.

- C. Lower pipe carefully into trench; lay true to line and grade.
- D. Provide smooth and uniform invert; bear spigots against bell shoulders or tongues against grooves.
- E. Line and grade: provide batter boards or laser light for line and grade control.
 - 1. Batter boards:
 - a. Offset hubs: set at 25' intervals along lines.
 - b. Batter boards: set all batter boards; keep 3 batter boards adjacent to consecutive hubs in place at all times; set at convenient height in feet below flow line grade; carry centerline on all batter boards at hubs.
 - c. Check grade of each pipe length with gauge rod; check line of each pipe length with plumb bob.
 - d. Keep pipe clean of all dirt and foreign material.
 - e. Use no defective pipe; check each length for defects and hairline cracks at ends prior to lowering into trench.
 - 2. Laser light:
 - a. Provide, install and operate laser light equipment for line and grade control.
 - b. Provide and install detection equipment to constantly monitor laser light to prevent movement or drift of light from line and grade.
 - c. Check line and grade on each pipe with laser light.
- F. Continuously check alignment of sewer by flashing light between manholes or between last piece of pipe laid and opening at downstream manhole; correct misalignment, displacement or otherwise defective sewer at Contractor's expense.
- G. Install 2" wide detectable warning tape in trench directly over plastic sewer pipe for full length of pipe and buried 1' to 2' below ground surface.

3.03 PRESSURE PIPE INSTALLATION

- A. Lay pipe in dry; minimum earth cover: 5'-0"; lay to depths or grades shown on drawings.
- B. Clean pipe interior of foreign material before lowering into trench; keep clean at all times by closing open ends of pipe and fittings.
- C. Before installation of metallic pipe, tap pipe lightly with light hammer to detect cracks; defective, damaged or unsound pipe will be rejected.
- D. Place in trench in sound, undamaged condition; do not injure pipe coating or lining; do not use end hooks to install or move pipe; use web slings; install polyethylene encasement on ductile iron pipe per ASTM C105.
- E. Cut pipe in neat and workmanlike manner without damage to pipe.
 - 1. Mechanical pipe cutters subject to approval of Engineer.
 - 2. Bevel cut ends of metallic push-on type pipe.
 - 3. Completely coat damaged ends of cut metallic pipe with sealer compatible with pipe liner; spray-on type sealer which will adhere to lining at any temperature; pipe and fittings showing blisters or holes will be rejected by Engineer on site.
- F. Use suitable fittings where grade or alignment requires offsets of more than 3° per joint (5/8" per foot) for ductile iron pipe, 1-1/2° per joint for polyvinyl chloride pipe and according to manufacturers

recommendations for polyethylene pipe; manufacturers recommendations shall control for smaller allowable deflections.

- G. Install warning tape in trench directly over plastic pipe for full length of pipe and buried 1' to 2'; wrap around valves.
- H. Plug or cap and block all pipe ends or fittings left for future connections.
- I. Uncover existing mains a sufficient time ahead of pipe laying operations to determine fittings required to make connections; make connections between existing and new mains with specials and fittings as required.
 - 1. Contractor responsible for cost of side cuts.

3.04 DIRECTIONAL BORING

- A. Expose or pothole all pipes and utilities which are to be crossed; provide minimum 9" clearance except for water mains provide clearance as specified hereinafter.
- B. Change alignment gradually; do not exceed manufacturer's recommendation for minimum allowable radius; inject flowable fill or grout in bore holes to be abandoned; inject flowable fill or grout at same time tool string is removed to avoid collapse of cover material.
- C. Provide minimum 5.5' cover earth cover over top of pipe unless otherwise specified on plans.
- D. Cut exposed spline 1/2" from coupling wall to reduce soil drag; bevel couplings on leading edge to minimize soil friction
- E. Install tracer wire with pipe as specified hereinbefore.
- F. Clean out pipe upon completion of work.
- G. Contractor responsible for correct vertical and horizontal alignment; pipe installed with incorrect vertical and/or horizontal alignment will be replaced by Contractor with proper installation at no additional cost to Owner.
 - 1. Horizontal alignment between structures as shown on plans may be altered upon authorization of Engineer.
- H. Non-potable water for boring operations may be purchased from Geode State Park.

3.05 POTABLE WATER AND SEWER CONFLICTS

- A. Maintain minimum 10' lateral separation between potable water piping and any gravity sewer piping.
- B. Maintain minimum 18" vertical separation between bottom of potable water piping and top of gravity sewer piping with potable water above gravity sewer.
- C. At pipe crossings where minimum separation cannot be maintained, provide 20' length of ductile iron pipe for sewer centered on potable water pipe at no extra cost to Owner. Pressure test iron sewer pipe as specified herein.

- D. Adequately support existing water main to prevent settling or breakage.

3.06 TESTS

A. Pressure piping:

1. Test liquid piping systems with water before backfilling in accordance with ANSI/AWWA C600 for Pressure Piping; inspect all joints and valves for leakage after piping has been under pressure 24 hours.
2. Test air and gas piping systems with air; paint all joints and valves with soap solution, observe any bubbles; maintain test pressure on piping for not less than 4 hours; test pressure: twice average system working pressure.
3. Valve off, or otherwise isolate instruments, controls or other piping accessories which would be damaged by test pressure.
4. Provide test pumps, test plugs, pipe, and gauges, and make required piping connections.
5. Retest piping showing leakage; replace or repair defective pipe, fittings and valves disclosed during tests to satisfaction of Engineer.

B. Gravity sanitary sewer piping and manholes: conduct all leakage tests after backfilling sewer pipe and manholes. Maximum allowable leakage for infiltration or exfiltration of sewer and manholes shall be 200 gallons per inch diameter per mile of pipe per day; retest piping showing leakage; replace or repair defective pipe. Manholes may be tested separately.

1. Sewer infiltration test: conduct infiltration test if hydrostatic groundwater level is 2' or more above top of pipe at highest point in section being tested. Engineer may require installation of groundwater monitoring well to gauge water level above top of pipe. Test according to one of the methods specified herein.
 - a. Hydrostatic test:
 - (1) Cap or plug all service connections and stubs to prevent entrance of groundwater into line at these locations.
 - (2) Maintain test head for not less than 24 hours before weir measurement is made.
 - (3) Measure infiltration by means of V-notch weir located in downstream manhole.
 - b. Air test:
 - (1) Test according to ASTM C828.
 - (2) Add air to line segment being tested until internal air pressure is 4.0 psi gauge greater than the average back pressure of groundwater over the pipe.
 - (3) Total height of water in feet above the pipe shall be divided by 2.31 to establish the pounds in pressure (psi gauge) to be added to the test pressure.
2. Sewer exfiltration tests: test sewer for exfiltration where infiltration test does not apply. Test according to one of the methods specified herein:
 - a. Hydrostatic test:
 - (1) Close inlet of upstream and downstream manholes with watertight bulkheads.
 - (2) Fill sewer and upstream manhole with water until elevation of water in upstream manhole is 2' higher than top of pipe in line being tested, or 2' above existing groundwater in trench, whichever is higher elevation:
 - (3) Measure exfiltration by determining amount of water required to maintain initial water elevation for 1 hour from start of test.
 - (4) If average head above section being tested exceeds 2', allowable leakage can be increased by 5% for each additional foot of head.
 - (5) This test is preferable for dry areas where groundwater head over pipe does not exist at time of test.
 3. Manhole exfiltration test:

- a. Plug inlet and outlet of manhole and fill manhole to depth used in testing line; allow water to stand 1 hour and refill to original elevation; after specific time, usually 15 min. to 1 hour, record difference in elevation and convert into gallons per hour lost through manhole leakage.
- b. To get actual line exfiltration subtract manhole loss from loss determined during line exfiltration test.

3.07 DISINFECTION

- A. Disinfect potable water, fire protection and water main piping.
- B. Disinfect: provide minimum residual chlorine content of 50 ppm in water main; allow system to stand full of solution for 24 hours by use of one of the following methods:
 1. Inject a solution of calcium hypochlorite and water at a slow rate into water main.
 2. Use chlorine tables securely fastened to pipe in accordance with manufacturer's recommendations followed by slowly filling water main in such a manner as to not dislodge tables from wall of pipe.
- C. Minimum free chlorine residual at pipe extremities: 10 ppm at end of test period; if requirement is not met, repeat disinfection procedure.
- D. Operate all valves and hydrants in new main to assure full disinfection; repeat test procedure if necessary.
- E. Thoroughly flush main after test until extremities indicate same chlorine residual as supply water.
- F. Within 24 hours after completion of disinfection and flushing, Owner will collect bacteriological samples and submit and pay for testing; sample must test "safe" before Owner will accept work.
- G. Conform to AWWA 651.
- H. Disinfect potable water, fire protection and water main piping specified under Section 13570 - Inside Process Piping, at same time.

END OF SECTION 02660

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes: Providing all material, tools, equipment, and labor necessary to complete the following:
1. Provide complete and functioning electrical power transmission, services and systems as shown on the Drawings, as specified herein, and as required for a complete and proper installation of a campground electrical system including, but not limited to:
 - a. Electrical service, complete, of size, voltage and type indicated or required to point of connection with utility company's equipment; all conductors shall be copper.
 - b. Service entrance with metering equipment and feed switches or breakers.
 - c. Main distribution panels and distribution panels or boards as needed.
 - d. Complete feeder system, underground, from the main distribution panels to individual campsite power outlets and branch panels.
 - e. Complete branch circuit wiring for receptacles, junction boxes, area lighting, and similar uses.
 - f. Exterior lighting fixtures, lamps and poles, terminal and splice boxes, campsite power outlets, switches, receptacles, controls, and motors, motor starters, detectable tape, and similar items.
 - g. Hangers, anchors, sleeves, bushings, conduits, conduit risers and elbows, supports for fixtures, equipment mounting structures, transformer pads and other electrical materials and equipment in association therewith.
 - h. Trenching and backfilling for underground electrical installation not specified elsewhere.
 - i. Connections to distribution panels in Buildings or existing utility company equipment, as shown on the Drawings.
 2. The omission of direct reference to an essential part, the necessity or use of which is reasonably implied shall not release the Contractor from providing the same.
 3. Inspect the site as necessary to become familiar with all existing conditions affecting the performance of the work under this Contract. Extras will not be allowed for failure to do so.
- B. Related Sections: Drawings and General Provisions of the contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements as well as, but not necessarily limited to, the following:

Section 02220 Trenching, Backfilling and Compacting

- C. Certain material may be provided by others to be installed under this contract. Coordinate with DNR Construction Inspector, utility company and other slated to provide material to be installed as part of this contract.

1.02 REFERENCES:

- A. Codes, Ordinances, and Standards: Comply with all applicable codes and regulations of the following:
 - 1. National Electric Code, latest edition;
 - 2. Local Utility Company Regulations;
 - 3. Underwriter's Laboratories.

1.03 SYSTEM DESCRIPTION:

- A. Power system shall be a 120/240 volt, 60 cycle, single phase 3-wire solid neutral, underground system.
 - 1. Ground circuits at the transformer/main distribution panel with a No.6 AWG continuous copper grounding conductor type THW routed with the circuit conductors.
- B. Verify the exact location of primary service, secondary service, and transformers at the job site.
- C. Underground Service Entrance: Unless otherwise specified elsewhere conductors will be continuous direct burial cable, USE or UF neoprene jacket insulated and moisture resistant non-metallic outer covering.
 - 1. Minimum burial depth 24 inches.
 - 2. Furnish and install number and size of conductors shown or as required by N.E.C.
 - a. All conductors shall be copper.

1.04 SUBMITTALS:

- A. Submit shop drawings, diagrams, and product information, material lists and manufacturer's specifications to Project Engineer before obtaining material, including but not necessarily limited to the following:
 - 1. Panelboards, power outlets, and equipment.
 - 2. Each specialized installation or system, including assembly or coordination Drawings.
- C. Product Data, Submit:
 - 1. Materials list of items proposed to be provided under this section;

2. Manufacturers' specifications and other data needed to prove compliance with the specified requirements;
 3. Manufacturers' recommended installation procedures which, when approved by the Project Engineer, will become the basis for accepting or rejecting actual installation procedures used on the work.
- D. Manual: Upon completion of this portion of the work, and as a condition of its acceptance, deliver to the Project Engineer two copies of an operation and maintenance manual, which shall include:
1. Copy of the approved Record Documents for this portion of the work;
 - a. Shop drawings, diagrams, material lists, and product information.
 - b. As-built drawings showing any changes in construction, additions and/or deletions from the Project Engineer's Drawings.
 2. Copies of all circuit directories;
 3. Copies of all warranties and guarantees.

1.05 QUALITY ASSURANCE:

- A. Qualification of Installers: For the actual fabrication, installation, and testing of the work in this section, use only thoroughly trained, licensed, experienced workers completely familiar with the items required and with the manufacturer recommended methods of installation.
1. In acceptance or rejection of installed work, no allowance will be made for lack of skill on part of workers.
- B. Provide only new materials of grade and quality specified. Unless otherwise approved or specified, provide only materials, equipment, devices, fittings, etc., of U.S. manufacture.
- C. Except as otherwise indicated, comply with the provisions of NEC and the standards by NEMA for electrical components.
1. Provide UL listed and labeled products where applicable.

1.06 DELIVERY, STORAGE, AND HANDLING:

- A. Protection: Use all means necessary to protect the materials of this section before, during, and after installation and to protect the work and materials of all other trades.
- B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Project Engineer/DNR Construction Inspector and at no additional cost to the Owner.

1.07 SEQUENCING AND SCHEDULING:

- A. Coordination of Work: Plan all work so that it proceeds with a minimum of interference with the work of other trades.
 - 1. Coordinate all openings, special frames and sleeves required in the building construction for electrical work with the construction work of others both within and outside of this Contract.
- B. Cooperation with Other Trades: Coordinate the work to be performed in compliance with the requirements of other trades and afford other trades reasonable opportunity for the execution of their work.
 - 1. Coordinate this work shall with the work of other trades at such time and in such a manner as not to delay or interfere with their work.
 - 2. Examine the Contract Documents to determine the requirements of other similar trades.

1.08 WARRANTY:

- A. Guarantee the entire installation, including every part and every specialized system, to the exception of lamps, from the standpoint of workmanship and material for one year after formal acceptance by the Project Engineer.
- B. Correct any defects becoming apparent during the guarantee period at no cost to the Owner.
- C. Do not construe this guarantee requirements as obligating the Contractor to make repair or replacements for equipment failure as a result of improper operation or maintenance by the Owner.

1.09 MAINTENANCE STOCKS:

- A. Provide 5 percent excess over the required amount of spring-loaded nuts, washers, conduit clamps, and other specialized fasteners for mounting electrical equipment.
 - 1. Store where directed by the DNR Construction Inspector.
- B. Prior to the acceptance of the equipment with plug-in receptacles and ground fault interrupters, provide two GFI testers to be used by the DNR for testing and remain the property of the DNR thereafter.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

- A. Subject to compliance with requirements, manufacturer offering electrical material and components which may be incorporated in the work include, but are not limited to, the following:
 - 1. Square D
 - 2. General Electric

3. ITE
4. Westinghouse
5. Hubbell
6. Bryant
7. Arrow-Hart

2.02 MATERIALS:

- A. Provide only materials that are new, of the type and quality specified.
 1. Where Underwriter's Laboratories, Inc. have established standards for such materials, provide only materials bearing the UL label.
- B. Provide only copper conductors as part of permanent installation within this project, from connection with the power company's equipment to connection to fixtures, receptacles or other devices or appliance as specified herein.
 1. The Project Engineer will not approve others for use anywhere within this project at any location.
 2. Remove any wire or cable used on this project which does not meet this requirement and replace at no cost to the Owner.
- C. Temporary Power:
 1. In addition to providing temporary power, provide and pay the costs for installing permanent electrical meter or meters as required;
 2. When permanent metering is in place and connected, the Owner will pay the costs for electrical power charged against the meter or meters.

2.03 COMPONENTS:

- A. Distribution Panels:
 1. Circuit breaker type with single main disconnect, solid neutral with voltage and main bus rating equal to or exceeding rating on panel schedule.
 2. Boxes: Code gauge steel, galvanized, with surface cover.
 3. Trim: Code gauge steel with grey enamel finish and door, complete with directory of circuits and key locked.
 4. Branch circuit breakers: Plug-in or bolt-in, of rating and poles indicated, with thermal-magnetic tripping mechanism at each pole, with quick-make and quick-break action, toggle type operating mechanism.
 - a. Provide multiple pole breakers with a common trip.
 - b. Provide breakers with ground fault protection for outlets as required by Code, except for outlets requiring ground fault interruption as indicated on the

Drawings for which separate and individual ground fault protection and reset features will be provided integral to the outlet.

5. Provide panels, for 200-Amp or less and 120/240 volt service, with amperage indicated, as manufactured by, but not limited to, one of the following:
 - a. Square D
 - b. General Electric
 - c. ITE
 - d. Westinghouse
 6. Provide main distribution panels: For 225-Amp, 400-Amp, or 600-Amp, and 120/240 volt service, as shown on the Drawings, provide main distribution panels with solid neutral and equipment ground bar installed, dead-front enclosed board assembly, NEMA type 3R rain-proof cabinet with concealed door hinge, gasketed door, 3-point vault-type locking mechanism with chrome finish padlock handle, with rust inhibiting primer and a finish coat of standard grey baked enamel, as manufactured by, but not limited to one of the following:
 - a. Square D
 - b. General Electric
 - c. Others as approved by the Project Engineer
 7. U.L. approved and N.E.C. rated.
- B. Wiring Devices:
1. Receptacles: Specification grade, duplex, 3-pole grounding type, amperage as shown, 125 V AC as manufactured by, but not limited to, one of the following:
 - a. Hubbell
 - b. Bryant
 - c. Leviton
- C. Fittings, Boxes, Etc.:
1. All outlet boxes, junction boxes, and switch boxes shall be code gauge galvanized steel.
 2. Boxes shall be square, rectangular, or octagonal of a suitable and ample size.
- D. Raceways and Fittings:
1. Conduit shall be rigid galvanized steel conduit with compression or tap-on type fittings.
 2. Conduit installed in concrete slab or underground shall be rigid galvanized coated with asphaltum paint.
 3. All conduit and fittings shall be U.L. approved and N.E.C. rated.
 4. No conduit smaller than 3/4" shall be used.

5. Roadway conduit: Unless otherwise noted on the Drawings or elsewhere in the specifications, provide 2-1/2" diameter, schedule 80 PVC, UI listed at 90 degrees, UV resistant electrical conduit for the installation of conductors beneath roadways.
 6. Provide rigid galvanized steel electrical conduits, threaded at the top to accept rain-tight cap, for mounting of distribution of panels and equipment.
 - a. Rain-tight cap: galvanized steel, threaded fitting suitable for capping open end of rigid steel electrical conduit.
 7. Corrugated flexible PVC Conduit: Where direct burial cable is not used provide unspliced, high tensile pvc corrugated flexible conduit to IPS dimensions, suitable for underground secondary distribution and under roadway application for protection of type TW, THW, RHW, or XHHW conductors used underground.
 - a. Provide IPS dimensions, schedule 430 PVC accessories including, but not necessarily limited to, couplings, adaptors, end bells and plugs, and PVC solvent cement suited for watertight joints.
 - b. Provide Corrugate flexible PVC conduit and accessories manufactured by Carlon, Cleveland, Oh., or approved equals.
- E. Interior Conductors and Conductors Installed in Watertight Underground Conduits:
1. Wire and cable shall be 600 V insulated N.E.C. standard type TW, THW, RHW, or XHHW, and color coded.
 2. All wiring shall be copper and No.12 AWG or larger, wires No.8 and larger shall be stranded.
- F. Direct Burial Conductors:
1. Wire and Cable: 600 V insulated, NEC standard, type USE or UF, as shown on the Drawings
 2. All wiring shall be copper and No.12 AWG or larger, wires No.8 and larger shall be stranded.
- G. Grounding devices:
1. Grounding Electrodes: 5/8" diameter, minimum 10 feet long unless otherwise shown, "Copperweld" ground rods.
 2. Electrode Conductor: Copper, no.6 AWG or larger, and type THW. Use clamp suitable for burial to fasten grounding conductor to rod.
- H. Safety Switches:
1. Provide heavy duty, horsepower rated, quick-make and quick-break design, externally operated with provision for padlocking, fusible or non-fusible as shown on the Drawings.

- a. Equip with field or factory installed solid neutral assembly and service grounding kit.
 2. Provide enclosure clearly marked for maximum voltage and horsepower rating, and:
 - a. Indoor: NEMA type 1.
 - b. Outdoor: NEMA type 3R, rain tight.
 3. For dual rated switches, provide rating indicated on a metal plate riveted or otherwise permanently fastened to the enclosure.
 4. Provide safety switches for 120/240 volt service, amperage as indicated as manufactured by, but not limited to one of the following:
 - a. Square D
 - b. General Electric
 - c. ITE
 - d. Westinghouse
 5. Safety switches shall be UL approved and NEC rated.
- I. Campsite Power Outlets:
1. The following are the only approved receptacle to be provided for recreational vehicle use on campsites:
 - a. 5-20R GFI, 20 AMP duplex, 125 volts, in accordance with ANSI/NEMA WD 6-1989, for recreational vehicles.
 - b. R-32-U, 30 AMP duplex, 125 volts, in accordance with ANSI/NEMA WD 6-1989, for recreational vehicles.
 - c. 14-50R, 50 AMP duplex, 125/250 volts in accordance with ANSI/NEMA WD 6-1989, for recreational vehicles.
 2. Provide individual recreational vehicle site service entrance equipment, as shown on the Drawings, UI listed and labeled "Suitable for Recreational Vehicle Service Equipment", as manufactured by Midwest Electrical Products, Inc. P.O. Box 910, Mankato, Minnesota, Tel No. 507/625-4414, or approved equal.
 3. Metallic R.V. Equipment: Unless otherwise noted on the Drawings, power outlets shall contain the circuit breaker and receptacles as specified herein.
 - a. Single unit Midwest Model No. U075CP6010, single unit Millbank Model No. U5200-XL-75 or approved equal for 50 Amp sites.
 - b. Double unit Midwest Model No. U075CB6010, double unit Millbank Model No. U5220-XL-75 or approved equal for 50 Amp sites.

- c. Provide NEMA 3R, light grey baked enamel, uni-post mounted power outlets, completely factory wired and assembled, with loop-feed lugs to accept specified wire size. Power outlet box to be 14-gauge galvanized steel. Post to be 12-Gauge galvanized steel.
 - d. Install stabilizer foot and post extension on pedestal as a footing base unless otherwise shown on the Drawings, or an alternate stabilization method is approved.
 - 4. Nonmetallic R.V. Equipment: Injection Molded, thermoplastic enclosure with Corrosion resistant internal components, factory wired power receptacles in 20 and 30 AMP configuration, protected by a 30 AMP ground fault interrupter main breaker, a hinged cover to protect R.V. plugs. Midwest model No. U71 "Parkmate" or approved equal.
 - a. Terminal lugs will accept 1/0 copper cables.
 - b. The power center will be rated 100 AMP maximum, 120/240 volts, single phase, 3 wire with ground.
 - c. Power to be factory mounted on 12 gauge galvanized steel, grey baked on enamel, vented post for underground services, with loop-feed twin 2-300 MCM terminal per phase lugs.
 - d. Install stabilizer foot and post extension on pedestal as a footing base unless otherwise shown on the Drawings, or an alternate stabilization method is approved.
 - e. Provide a seven watt fluorescent light protected by an in-line fuse circuit protection and molded polycarbonate light cover.
 - f. Provide additional options as shown on the Drawings. Other options may include a light with manual switch or photo electric sensor, single service cable TV jack for type RG-59 coax cable, single service telephone jack type PH6596.
- J. Detectable Warning Tape: 3-inch wide electronically detectable tape with markings: "Caution - Electrical Power Lines Below" provided by, but not necessarily limited to, one of the following:
 - 1. Terra Tape D, Reef Industries, Inc., Houston, Texas
 - 2. Dectatape, Allen Systems, Houston, Texas
 - 3. Detectable Marking Tape III, Lineguard, Inc., Weaton, Illinois
- K. GFCI Testers: Provide GFCI testers capable of indicating wiring errors and faulty GFI equipment.
 - 1. Unitest GFI model No. 5708 manufactured by Beha Corporation, Clearwater, Fl. or approved equals.

- L. Mounting Channels and accessories: Provide 1-5/8" series, galvanized steel channels and accessories for mounting distribution panels, meters, and safety switches, including conduit clamps and spring-loaded nuts, provided by, but not necessarily limited to, one of the following:
 - 1. Unistrut, GTE Products Corp., Wayne, MI.
 - 2. Power-Strut, Elcen Metal Product Co., Franklin Park, IL.
- M. Terminal and Splice Boxes: NEMA type 3R rain proof code approved cabinets, with removable door with stay-open position, provision for padlocking, concentric knockouts, and heavy zinc-coated finish, of sufficient voltages.
 - 1. Include field or factory installed grounding kit.
 - 2. Provide boxes for 120/240 service, UL approved and NEC rated, of amperage indicated, as manufactured by, but not limited to, one of the following:
 - a. Square D
 - b. Midwest Electric Products, Inc.
- N. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Project Engineer.

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. Examine the areas and conditions under which the work of this section will be installed. Correct conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.
- B. Verify location and configuration of existing facilities in relation to the work of this section before preparing bid.
- C. Verify depths and location so all existing underground utilities

3.02 PREPARATION:

- A. Coordination: Coordinate installation of electrical items with the schedules for other work, to prevent unnecessary delays in the total work.
- B. Where electrical items are shown in conflict with locations of structural members and mechanical or other equipment, provide all required supports and wiring to clear the encroachment.
- C. Accuracy of Data: The data indicated on the Drawings and in these Specifications are as exact as could be secured, but their absolute accuracy is not guaranteed.

1. Exact locations, distances, levels, and other conditions will be governed by actual construction.
 2. Use the Drawings and these Specifications for guidance, and secure the DNR Construction Inspector's approval of all changes in locations.
- D. Measurements: Verify all measurements at the site.
1. No extra compensation will be made because of differences between locations shown on the Drawings and measurements at the site, except as provided In the General Covenants and Provisions.
- E. Circuiting: The branch circuits have been designed for maximum economy consistent with sizes for voltage drop and other considerations.
1. Circuits and wire sizes shall be in accordance with the N.E.C. Install circuits as shown on the Drawings unless otherwise approved by The Project Engineer.
- F. Electrical circuit drawings are diagrammatic in nature but are to be followed as closely as made possible by the actual construction and interface with the work of other trade in this or other contracts.
1. Where deviations are approved to conform with actual construction and the work of other trades, make such deviation without additional costs to the Owner, except as provided elsewhere in the Contract Documents.
- G. Trenching and backfilling is required for installation of the work of this section. Perform all such trenching and backfilling in strict accordance with the provisions of Section 02200 of these Specifications.

3.03 INSTALLATION:

A. Conduits:

1. Where conduit is installed in concrete slabs, on the ground, underground, or exposed to the weather, make all joints liquidtight and gastight.
 - a. Bury all underground conduit to a depth of 2'0" below finished grade unless otherwise shown on the Drawings.
 - b. Install necessary sleeves, chases, bushings, and approved sealants where conduits pass through slabs, floors, walls and other structures.
 - c. Make necessary openings and spaces while keeping cutting and patching of work by other to an acceptable minimum.
2. Install bushing at conduit ends, to protect wires from abrasions, where conduit enters box or other fittings.
3. No conduit smaller than 3/4" shall be used for a branch circuit in this project.

- a. Unless otherwise specified, provide code-size conduit for number and size of wire required by Code.
 4. Where conduit is exposed, run parallel to or at right angle with lines of the building.
 - a. Make bends free from dents and flattening with standard conduit elbows or conduit bent to not less than the same radius.
- B. Roadway Crossing Electrical conduit:
1. Install specified conduit at location indicated on the Drawings by boring, jacking into place, or trenching, when permitted by the DNR Construction Inspector, into unpaved roadways.
 2. Identify roadway crossing location by placing two 2" P-K nails, one inch apart, six inches from each side of pavement.
 - a. In addition install a 12-inch long reinforcing rod or a 24-inch long treated wood stake at each end of conduit.
 3. Plug and cap each end of conduit placed beneath roadway for future circuit installation.
 - a. Sand fill around each end to aid future location and installation.
 4. Install conduit for primary circuits below the location of conduit for primary circuit where they are indicated on the Drawings to cross at the same location.
- C. Installation of Conductors:
1. All conductors used for branch circuits will be minimum number 12 protected by 20 ampere circuit breakers.
 - a. Install larger wires where necessary to limit voltage drop or as required by NEC.
 2. Conductors will be installed continuous from outlet to outlet and no splices shall be made except within outlet or junction boxes.
 3. No underground splice will be permitted.
 - a. Conductors will run continuously from the main distribution panel to the terminal bar located in the first R.V. site service entrance equipment post on the circuit and continuously thereafter from terminal bar to terminal bar.
 4. Balance the campsite loads between the two phase conductors by connecting the loads to alternate sides of each 120/240 volt, three wire circuit.
 - a. Follow NEC requirements to provide for coding convention to consistently identify conductors throughout the project.
 3. No more than three circuits will be permitted in one raceway.
 - a. A common neutral may be used as permitted by the National Electric Code.

4. Terminals and Splices: Stranded conductors shall be terminated with approved copper connecting lugs, accommodating the full diameter of the bare conductor.
 - a. Mains and feeders shall run their entire lengths in continuous sections without joints or splices.
5. Splices will be permitted only at outlet or junction boxes.
 - a. Splices shall be thoroughly cleaned, mechanically and electrically secured without solder, then soldered.
 - b. After soldering, wrap rubber and friction tape.
 - c. Vinyl plastic tape will be acceptable subject to the approval of local inspection authorities.
 - d. Scotch lock type S, M, L, and D connectors will be approved as equal to soldering.

D. Installation of main distribution panels:

1. Mount main distribution panels using specified conduit support posts and mounting channels, clamps and accessories as shown on the Drawings.
 - a. Install the rain-tight cap on top of support posts.
2. Unless otherwise specified, install copper studs and spade type bushings in utility company transformer, and install secondary connections between transformer and the main distribution panel.
 - a. Seek approval of utility company representative prior, during and after installation.
3. Install meter where indicated on The Drawings or as instructed by the utility company.
 - a. Installation subject to approval of utility company.
 - b. Provide utility company approved meter if so instructed by utility company.
4. Directories: Mount a typewritten directory behind glass or plastic on the inside of each panel door.
 - a. Show circuit numbers and circuit description for all outlets in each circuit.
5. Mounting Heights: To center of box above finished floor for the below-named items, shall be as follows, unless otherwise shown or indicated.
 - a. Flush toggle switches: 48".
 - b. Convenience outlets and similar: 12" - finished areas (unless noted otherwise).
 - c. Convenience outlets and power outlets: 48".

- d. Safety switches: 54" to operator.
 - e. Motor controllers: 54" or top even with safety switch.
 - f. Panelboards: 72" to top.
 - g. Other mounting heights are indicated on the Drawings by detail or by a plus dimension shown adjacent to the symbol.
- E. Grounding System: Ground all equipment including panelboards, transformers, conduits systems, junction and splice boxes, RV site service equipment, motors and other apparatus, by conduit or conductor to grounding electrode as shown on the Drawings, using grounding clams suitable to direct burial.
- 1. Locate grounding electrode in area which will receive ground water regularly, and drive rod to depth of at least 8 feet.
 - 2. Test to measure ground resistance, and provide not more than 5 ohms resistance, adding ground rods as required to achieve that level.

3.04 FIELD QUALITY CONTROL:

- A. Testing: At the conclusion of the work, test each and every circuit to establish the proper operation of electric equipment and freedom from improper ground and to ascertain the insulation values which shall not be lower than those required by the National Electrical Code.
- 1. Test of equipment grounding conductors will show a resistance of no more than 25 ohms at any point on the circuit, except for grounding electrode which will show a resistance of no more than 5 ohms.
- B. Carry out final test in the presence of the Project Engineer/DNR Construction Inspector.
- C. Correct all work not meeting code requirements, and all circuits which fail testing, at no additional cost to the Owner.

3.05 CLEANING:

- A. Exposed conduits, panel boards, fixtures, switches, hangers, and equipment exposed shall be thoroughly cleaned.
- B. Fixture glass and shields shall be cleaned and washed.
- C. Keep premises free from unnecessary accumulation of rubbish and debris resulting from the work of this section.
- D. Dispose of all debris resulting from the work of this contract at no additional cost to the Owner.

END OF SECTION 02785

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes: Seedbed preparation and application of seed mixtures and fertilizer to all areas designated on the Drawings or all areas within the boundaries of this project having been disturbed by works of this project and not receiving finished surfacing, as determined by the DNR Construction Inspector and as specified herein.
- B. Related Sections: Drawings and General Provisions of the Contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements as well as, but not necessarily limited to, the following:

Section 02200 - Earthwork

1.02 REFERENCES:

- A. Standards of materials and construction shall conform with the Standard Specifications for Highway and Bridge Construction, 1997 Series of the Iowa Department of Transportation.

1.03 QUALITY ASSURANCE:

- A. Codes and Standards: Perform all work of this section in accordance with the requirements of the "Standard Specifications" 1997 I.D.O.T. Section 2601.

1.04 PROJECT/SITE CONDITIONS:

- A. Environmental Requirement:
 - 1. Weather conditions shall be observed. Seeding shall be performed only during normal application periods, optimum temperature, moisture and climatic condition to promote germination and plan growth. Normal application periods are between March 1 and May 31 and between August 10 and September 30.
- B. Existing Conditions: Survey job conditions prior to commencing work. Bring any discrepancies between existing work and the Drawings and Specifications to the attention of the Project Engineer/DNR Construction Inspector.

1.05 SEQUENCING AND SCHEDULING:

- A. Properly coordinate the work of this section with all other trades.
- B. Do not start the work of this section until the work of all other trades has been completed unless otherwise approved by the DNR Construction Inspector.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. All topsoil used for seedbed shall be in accordance with Section 02200.
- B. All seeds shall be "redtag" quality or better supplied from the latest available crop, free of noxious weed seed and supplied in the following varieties and percentages of weight.
- C. Provide mixture of types and quantities as specified herein for seeding of areas designated by the Project Engineer, the DNR Construction Inspector as indicated on the Drawings, and as specified herein.

- 1. Class "A" Mixture: For areas to remain in semi-natural state where mowing is required only as a temporary control measure.

Fescue, Kentucky 31	25 lbs. per acre
Switchgrass (Blackwell)	8 lbs. per acre
Alfalfa (Northern Grown)	5 lbs. per acre
Birdfoot Trefoil (Empire)	4 lbs. per acre
Alsike Clover	4 lbs. per acre

- 2. Class "B" Mixture: For same situation as where Class "A" mixture is used but where a lighter mix is preferable.

Fescue, Kentucky 31	20 lbs. per acre
Switchgrass (Blackwell)	3 lbs. per acre
Alfalfa (Northern Grown)	4 lbs. per acre
Birdfoot Trefoil (Empire)	4 lbs. per acre
Alsike Clover	4 lbs. per acre

- 3. Class "C" Mixture: For area designated as fine seeded, lawns or other mowed grass areas.

Bluegrass, Kentucky	70%
Ryegrass, Perennial, Fineleaf	10%
Fescue Creeping Red	20%

- 4. Class "D" Mixture: For all areas, unless otherwise specified, where a prairie grass in natural state is required.

Big Bluestem	30 lbs. per acre
Switchgrass (Blackwell)	5 lbs. per acre
Sideoats Grama	5 lbs. per acre
Little Bluestem	5 lbs. per acre

- D. Seed is to be delivered on site in separate packaging for each individual type of seed within each mixture and mixed in the presence of the DNR Construction Inspector if required.

Commercial mixture in the quantities as specified will be acceptable at the discretion of the DNR Construction Inspector, if these quantities are verifiable.

- E. Seed mixture for this project to be selected by the DNR Construction Inspector.

2.02 FUNGICIDE:

- A. All seeds for permanent seeding shall be treated with a nonmercurial fungicide (75% concentration or equivalent) at the rate of 5-1/2 ounces per 100 pounds of seed.

PART 3 - EXECUTION

3.01 EXAMINATION:

- 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.

3.02 SEEDBED PREPARATION:

- A. The area to be seeded shall be raked or graded to fill washes or gullies. Pick up and dispose of all debris, including stones, boulders, logs, stumps, or other foreign material that will interfere with the seeding operation.

3.03 FERTILIZER APPLICATION:

- A. Spread fertilizer over the area at the rate of 750 pounds per acre of 15-15-15 (or equivalent).
- B. Unless otherwise indicated, spread all fertilizer with a mechanical spreader which will secure a uniform rate of application.
- C. Spread fertilizer after the preliminary preparation of seedbed and prior to the sowing of any seeds.
- D. Disk the fertilizer and roll the area prior to seeding.
- E. On area inaccessible to field machinery, spread fertilizer after preparation of the seedbed and thoroughly rake into the soil.
- F. Application of fertilizer in combination with seeding by hydraulic seeder as specified in I.D.O.T. Section 2601.04H will be acceptable at the discretion of the DNR Construction Inspector.

3.04 SEED APPLICATION:

- A. Preparation: Mix all seeds specified for this project thoroughly at the project site prior to placing in spreading equipment.

- B. On all areas accessible to field machinery, all grass seeds may be sown with a gravity, cyclone or hydraulic seeder as specified herein. On areas inaccessible to field machinery, the use of hand-cyclone seeder will be permitted.
- C. Apply seed mixture at a rate of four pounds per 1,000 square feet, unless otherwise indicated, during fair, calm weather. One half of the seed mixture shall be sown in one direction and the remainder at right angles to the first sowing.

3.05 SEED APPLICATION IN MAINTAINED LAWNS:

- A. For maintained lawns to be seeded as part of this project, apply fertilizer prior to preparation of the seedbed.
- B. A rotary tiller will be required for preparation of the seedbed. The seedbed after tilling will be raked firm, smooth and free of clods, rocks and other debris.
- C. Roll the seedbed shall both before and after the application of seeds. Apply seeds over damp soil by broadcast seeding.
- D. Roll, seed, and fertilize by hand or with hand operated equipment in areas inaccessible to field equipment.

3.06 SPRING OVERSEEDING:

- A. Seedbed preparation will not be required provided the overseeding is applied when the ground is free from frost action after March 1 and before April 1 or as directed by the DNR Construction Inspector.

3.07 MOWING:

- A. When requested by the DNR Construction Inspector, mowing may be required prior to permanent seeding or anytime during the growing season.

3.08 MULCHING:

- A. All seeded areas are to be mulched unless otherwise designated in the contract documents.
- B. All areas requiring mulch are to be mulched as soon as seed is sown and final rolling is completed.
- C. Mulch is to be evenly and uniformly distributed and anchored into the soil. The application rate for reasonably dry material shall be approximately 1-1/2 tons of dry cereal straw, 2 tons of wood excelsior, or 2 tons of prairie hay per acre, or other approved material, depending on the type of material furnished.
 - 1. All accessible mulched areas are to have mulch consolidated into the soil with a mulch stabilizer, and slope areas are to be tucked on the contour.

2. Crawler type or dual wheel tractors are to be used for the mulching operation. Equipment is to be operated in a manner to minimize displacement of the soil and disturbances of the design cross section.

END OF SECTION 02930

IOWA DEPARTMENT OF NATURAL RESOURCES

DIVISION III

CONCRETE

IOWA DEPARTMENT OF NATURAL RESOURCES
ENGINEERING AND REALTY SERVICES BUREAU
WALLACE STATE OFFICE BUILDING
DES MOINES, IA 50319-0034

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes: All labor, materials, and equipment required to construct, shore, and remove all forms to accommodate all concrete specified in Section 03300, Cast-In-Place Concrete, as shown on the Drawings, and as specified in other sections of these specifications.
- B. Related Sections: Drawings and General Provisions of the Contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements as well as, but not necessarily limited to, the following:
 - Section 03200 - Concrete Reinforcement
 - Section 03300 - Cast-In-Place Concrete

1.02 REFERENCES:

- A. Safety: All formwork and methods of construction shall conform to the requirements of the state of Iowa Bureau of Labor and all OSHA Standards.
- B. A.C.I. 347.

1.03 SUBMITTALS:

- A. Provide concrete mix formula to Construction Inspector.
- B. Manufacturer's Data: Within 30 calendar days after award of the contract, submit manufacturer's data and installation instruction for proprietary materials including form coatings, ties and accessories, and manufacturer's form system if used.
- C. Shop Drawings: When requested by the DNR Construction Inspector or the Project Engineer for the purpose of explaining details or structural integrity, the Contractor shall submit those drawings requested prior to construction of the project.

1.04 QUALITY ASSURANCE:

- A. Formwork: Design of formwork is the responsibility of the Contractor.
- B. Standards: Comply with all applicable provisions of ACI 347.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Form Materials:
 - 1. Construct formwork for exposed concrete surfaces with smooth-faced undamaged plywood, undented metal, or other panel-type materials acceptable to the DNR Construction Inspector, to provide continuous, straight, plumb, smooth cast surface, furnish in largest practical sizes to minimize number of joints.

2. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without reflection or bowing.
- B. Form Ties:
1. Provide factory-fabricated, adjustable length removable or snap-off metal form ties, designed to prevent form deflection and to prevent spalling concrete surfaces upon removal.
 2. Provide ties so that portion remaining within concrete after removal of exterior parts is at least 1-1/2" from the outer concrete surface. Form ties shall not leave a hole larger than 1" diameter in the concrete surface.
- C. Form Coating: Provide commercial formulated form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces requiring bond or adhesion, nor impede the wetting of surfaces to be cured with water or curing compounds.

2.02 DESIGN OF FORMWORK:

- A. General:
1. Design, erect, support, brace, and maintain formwork so that it will safely support vertical and lateral loads that might be applied, until such loads can be supported by the concrete structure.
 2. Carry vertical and lateral loads to ground by formwork system and in-place construction that has attained adequate strength for that purpose.
 3. Construct formwork so that concrete members and structures are of correct size, shape, alignment, elevation, and position.
 4. Design forms and falsework to include assumed values of live load, dead load, weight of moving equipment operated on formwork, concrete mix, height of concrete drop, vibrator frequency, ambient temperature, foundation pressures, stresses, lateral stability, and other factors pertinent to safety of structure during construction.
 5. Provide shore and struts with positive means of adjustment capable of taking up formwork settlement during concrete placing operations, using wedges or jacks or a combination thereof.
 6. Provide trussed supports when adequate foundations for shores and struts cannot be secured.
 7. Support form facing materials by structural members spaced sufficiently close to prevent objectionable deflection.
 8. Fit forms placed in successive units for continuous surfaces to accurate alignment, free from irregularities, and within allowable tolerances.
 9. Provide camber in formwork as required for anticipated deflections due to weight and pressures of fresh concrete and construction loads.
 10. Provide formwork sufficiently tight to prevent leakage of cement paste during concrete placement. Solidly butt joints and provide backup material at joints as required to prevent leakage and fins.
- B. Earth Forms: Side forms of footings may be omitted and concrete placed directly against excavation only when requested by the Contractor and accepted by the DNR Construction Inspector. When omission of forms is accepted, provide additional concrete 1" on each side of the minimum design profiles and dimensions shown.

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. Examine the substrate and conditions under which work of this section is to be performed, and correct unsatisfactory conditions which would prevent proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 ERECTION:

A. General:

1. Construct forms complying with ACI 347, to the exact sizes, shapes, lines, and dimensions shown, and as required to obtain accurate alignment, location, grades, level, and plumb work in finish structures.
2. Provide for openings, offsets, sinkages, keyways, recesses, moldings, reglets, chamfers, blocking, screeds, bulkheads, anchorages, inserts, and other features required. Use selected materials to obtain required finishes.
3. Forms for openings and construction which accommodates installation by other trades whose materials and products must be fabricated before the opportunity exists to verify the measurements of adjacent construction which effects such installations, shall be accurately sized and located as dimensioned on the Drawings. In the event that deviation from the Drawing dimensions results in problems in the field, the Contractor shall be responsible for resolution of the conditions as approved by the Project Engineer, without additional expense to the Owner.

B. Fabrication:

1. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where the slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and assure ease of removal.
2. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Brace temporary closures and set tightly to temporary openings on forms in as inconspicuous locations as possible, consistent with design requirements. Form intersecting planes to provide true, clean-cut corners.

C. Falsework:

1. Erect falsework and support, brace and maintain it to safely support vertical, lateral, and asymmetrical loads applied until such loads can be supported by in-place construction. Construct falsework so that adjustments can be made for take-up and settlement.
2. Provide wedges, jacks, or camber strips to facilitate vertical adjustments. Carefully inspect falsework and formwork during and after concrete placement operations to determine abnormal deflection or signs of failure; make necessary adjustments to produce work of required dimensions.

D. Forms for Exposed Concrete:

1. Drill forms to suit ties used and to prevent leakage of concrete mortar around tie holes. Do not splinter forms by driving ties through improperly prepared holes.
 2. Provide sharp, clean corners at intersecting planes, without visible edges or offsets. Back joints with extra studs or girts to maintain true, square intersections.
 3. Use extra studs, walers, and bracing to prevent objectionable bowing of forms between studs and to avoid bowed appearance in concrete. Do not use narrow strips of form material which will produce bow.
 4. Assemble forms so they may be readily removed without damage to exposed concrete surfaces.
- E. Corner Treatment: Unless shown otherwise, form chamfers with 3/4" x 3/4" strips, accurately formed and surfaced to produce uniformly straight lines and tight edge joints on exposed concrete. Extend terminal edges to required limit and miter chamfer strips at changes in direction.
- F. Control Joints: Locate as directed by DNR Construction Inspector or as indicated on the Drawings.
- G. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Verify size and location of openings, recesses and chases with the trade requiring such items. Accurately place and securely support items to be built into forms.
- H. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before concrete is placed. Retighten forms immediately after concrete placement as required to eliminate mortar leaks.

3.03 INSTALLATION:

- A. Embedded Items:
1. General: Set and build into the work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of the items to be attached thereto.
 2. Edge Forms and Screeds: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in the finished slab surface. Provide and secure units to support types of screeds required.
- B. Shores and Supports: Comply with ACI 347 for shoring construction, and as herein specified. Submit a shore removal and re-shoring schedule and drawings for the DNR Construction Inspector review before proceeding with this work. Do not proceed until schedule and drawings have been reviewed.

3.04 APPLICATION:

- A. Form Coating: Coat form contact surfaces with form-coating compound before reinforcement is placed. Do not allow excess form coating material to accumulate in the forms or to come in contact with surfaces which will be bonded to fresh concrete. Apply in compliance with manufacturer's instructions.

3.05 FIELD QUALITY CONTROL:

- A. Inspection: Concrete shall not be placed in forms until inspected by DNR Construction Inspector and permission is given to start placing concrete.

3.06 CLEANING:

- A. General: Formwork not supporting concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 10 degrees C (50 degrees F) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operation, and provided that curing and protection operations are maintained.
- B. Formwork: Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements may not be removed in less than 14 days, and not until concrete has attained design minimum 28-day compressive strength. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of the concrete location or members, as specified in other sections.
- C. Form-Facing Material: Form-facing material may be removed four days after placement, only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.
- D. Reuse of Forms: Clean and repair surfaces of forms to be reused in the work. Split, frayed, delaminated or otherwise damaged form-facing material will not be acceptable. Apply new form-coating compound material to concrete contact surfaces as specified for new formwork. When forms are reused for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets.

END OF SECTION 03100

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes: All reinforcing steel, steel mesh, and accessories and the installation of these items for all concrete reinforcement for this project.
- B. Related Sections: Drawings and General Provisions of the contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements as well as, but not necessarily limited to, the following:

- Section 03100 - Concrete Formwork
 - Section 03300 - Cast-In-Place Concrete

1.02 REFERENCES:

- A. Comply with all applicable provisions of the following standards:
 - 1. CRSI "Manual of Standard Practice"
 - 2. ACI 315 "Details and Detailing of Concrete Reinforcement"
 - 3. ACI 318 "Building Code Requirements for Reinforced Concrete"

1.03 SUBMITTALS:

- A. Shop Drawings: Submit complete shop drawings of all materials proposed to be furnished and installed under this section in accordance with ACI "Manual of Standard Practice for Detailing Concrete Structure," ACI 315. Show:
 - 1. Bar schedule, stirrup spacing, diagrams of bent bars, arrangements and assemblies.
 - 2. Review shop drawings requirements with DNR Construction Inspector before ordering shop drawings.
- B. Mill Certificates: Submit steel producer's certificates of mill analysis, tensile and bend tests for reinforcing steel.

1.04 DELIVERY, STORAGE AND HANDLING:

- A. Delivery: Deliver reinforcement to the job site bundled, tagged, and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams.
- B. Storage: Store reinforcement at the job site in a manner to prevent damage and accumulation of dirt and excessive rust.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Steel and Wire Reinforcement: Reinforcing steel shall consist of deformed bars of the size called for on the Drawings. Steel shall conform to ASTM A615 Grade 40. Deformation shall conform to ASTM A305. Mill certificates showing conformity with these requirements shall be furnished to the Project Engineer for each melt. Wire reinforcement shall conform to ASTM A82. Welded wire fabric shall conform to ASTM A185.
- B. Tie Wire: No. 16 double annealed iron wire.
- C. Accessories: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement in place:
 - 1. Use wire bar-type supports complying with CRSI recommendations, unless otherwise indicated. Do not use wood, brick and other such unacceptable materials.
 - 2. For slabs on grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
 - 3. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with either hot-dip galvanized or plastic protected legs.

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. Examine the substrate, formwork, and the conditions under which concrete reinforcement is to be placed, and correct conditions which would prevent proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

- A. General:
 - 1. Comply with the specified standards for details and methods of reinforcement placement and supports, and as herein specified.
 - 2. Clean reinforcement to remove loose rust and mill scale, earth, and other materials which reduce or destroy bond with concrete.
 - 3. Position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.
 - 4. Place reinforcement to obtain the minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports together with 16 gauge wire to hold reinforcement accurately in position during concrete placement operations. Set wire ties so that twisted ends are directed away from exposed concrete surfaces.
 - 5. Bars are to be tied at all intersections except where spacing is less than one foot in each direction, in which case alternate intersections are to be tied.
 - 6. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh.
 - 7. Provide sufficient numbers of supports and of strengths to carry reinforcement. Do not place reinforcing bars more than 2" beyond the last leg of any continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

8. Splices: Provide standard reinforcement splices by lapping ends, placing bars in contact, and tightly wrapping tie wire around bars.
9. Galvanized or epoxy coated reinforcement: Weight of reinforcement will be calculated from the theoretical weight of the nominal sizes and actual lengths of the various sizes of reinforcement shown on the plans. No adjustment in weight will be made for galvanizing or epoxy coating.

END OF SECTION 03200

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes: Provisions for all labor and materials required to construct all walls, footings, piers and slabs, and all other work or items classified as cast-in-place concrete.
1. All concrete foundations and slabs as shown on the project plan, floor plans and building sections, as well as all other concrete not specified elsewhere, are classified as cast-in-place concrete.
- B. Related Sections: Drawings and General Provisions of the Contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements as well as, but not necessarily limited to, the following:
- Section 03100 - Concrete Formwork
Section 03200 - Concrete Reinforcement

1.02 REFERENCES:

- A. Codes and Standards: Comply with provisions of following codes, specifications and standards except where more stringent requirements are shown or specified.
1. Uniform Building Code, U.B.C., 1985 edition.
2. American Concrete Institute (ACI).
- a. Manual of Concrete Practice.
- b. ACI 301 - Specifications for Structural Concrete for Buildings.
- c. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete.
- d. ACI 305 - Hot Weather Concreting.
- e. ACI 306 - Cold Weather Concreting.
- f. ACI 308 - Standard Practice for Curing Concrete.
- g. ACI 318 - Building Code Requirements for Reinforced Concrete.
3. American Society for Testing of Materials (ASTM).
- a. ASTM C33 - Standard specification for concrete aggregates.
- b. ASTM C31 - Making and curing compressive and flexural strength test specimens in the field.
- c. ASTM C94 - Standard specification for ready-mixed concrete.
- d. ASTM C138 - Test for unit weight, yield and air content of concrete.

- e. ASTM C143 - Test for slump test of portland cement concrete.
 - f. ASTM C150 - Standard specification for portland cement.
 - g. ASTM C260 - Standard specification for air-entraining admixture for concrete.
 - h. ASTM C309 - Standard specification for liquid membrane-forming compounds for curing concrete.
 - i. ASTM C494 - Standard specification for chemical admixtures for concrete.
 - j. ASTM D994 - Standard specification for pre-formed expansion joint filler for concrete.
 - k. ASTM D1850 - Standard specification for concrete joint sealer, cold application type.
- 4. Concrete Reinforcing Steel Institute (CRSI).
 - a. Manual of Standard Practice.
 - 5. State of Iowa Building Code, latest edition.

1.03 SUBMITTALS:

- A. Product Data: Submit manufacturer's product data with application and installation instructions for proprietary materials and items, accessories, admixtures, patching compounds, water stops, joint systems, curing compounds, dry-shake finish materials, and others as required by Project Engineer.
- B. Samples: Submit samples of materials specified as requested by Project Engineer including names, sources and descriptions.
- C. Quality Control Submittals:
 - 1. Design Data: Submit data on proposed design mixes when trial batch method is used.
 - 2. Test Reports: Employ, when necessary, at Contractor's expense, a testing laboratory acceptable to the Project Engineer to perform material evaluation tests and submit reports.
 - 3. Material Certificates: Provide materials certificates in lieu of materials laboratory test reports when permitted by Project Engineer. Material certificates shall be signed by Manufacturer and Contractor certifying that each material item complies with or exceeds specified requirements.

1.04 QUALITY ASSURANCE:

- A. Qualifications:
 - 1. During the progress of installation of the work of this section, provide at least one worker who shall be thoroughly familiar with the specified requirements, completely trained and experienced in the necessary skills, and who shall be present at the site and shall direct all work performed under this section.
 - 2. Use adequate numbers of skilled workers to ensure installation in strict accordance with the approved design.

1.05 DELIVERY, STORAGE, AND HANDLING:

- A Protection: Use all means necessary to protect the materials of this section before, during, and after installation and to protect the work and materials of all other trades.
- B Replacement: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Project Engineer and at no additional cost to the Owner.

1.06 PROJECT/SITE CONDITIONS:

- A Environmental Requirements: Weather conditions shall be observed. No work shall be attempted in frozen conditions without written approval from the DNR Construction Inspector.
- B Existing Conditions: Review job conditions prior to commencing work. Bring any discrepancies between existing work and the Drawings and Specifications to the attention of the Project Engineer/DNR Construction Inspector.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

- A Subject to compliance with requirements, products from the following manufacturers can be incorporated into the work of this section.
 - 1. Euclid Chemical Co., 19218 Redwood Road, Cleveland, Ohio 44110.
 - 2. Master Builders Co., Ltd., 79 Kincort Street, Toronto, Ontario M6M3E4.
 - 3. Sika Chemical Corporation, P. O. Box 297, Lyndhurst, New Jersey 07071.
 - 4. Chem-Master Corporation, 477 Industrial Parkway, Chagrin Falls, Ohio 44022.
 - 5. W. R. Grace and Co., 62 Wittemore Avenue, Cambridge, Massachusetts 02140.
 - 6. W. R. Meadows, Inc., P. O. Box 543, Elgin, Illinois 60120.
 - 7. Protex Industries, Inc., 1331 West Evans Avenue, Denver, Colorado 80223.
 - 8. Sonneborn Building Products, 7711 Computer Avenue, Minneapolis, Minnesota 55435.
 - 9. Antihydro Co., 265 Badger Avenue, Newark, New Jersey 07108.
 - 10. L & M Construction Chemicals, Inc., 8316 Blondo Street, Omaha, Nebraska 68134.
 - 11. Glifford-Hill and Co., Inc., Woodland Green, Charlotte, North Carolina 28210.
 - 12. The Celotex Corporation, 1500 North Dale Mabry Highway, Tampa, Florida 33607.
 - 13. J & P Petroleum Products, Tex-Mastic Construction Materials, 2715 South Westmoreland, P. O. Box 4206, Dallas, Texas 75208.

2.02 MATERIALS:

- A Portland Cement: ANSI/ASTM C 150, Type I or Type III, high early-strength cements, unless otherwise acceptable to Project Engineer.
- B Normal Weight Aggregates: ANSI/ASTM C 33, and as herein specified.

1. Coarse aggregate for concrete shall consist of gravel or crushed stone particles, from a source approved by Iowa D.O.T., or combinations of these materials. The aggregate shall meet these requirements:
 - a. Abrasion loss: The percent of wear, determined in accordance with AASHTO T 96, Grading A or B, shall not exceed 35 for gravel and 50 for other crushed stone.
 - b. Durability: Coarse aggregate durability shall be a minimum of Class 1. Aggregate of Class 2 or Class 3 durability may be furnished by the Contractor, with the Project Engineer's approval, and at no extra cost to the Owner.
 - c. Gradation: Coarse aggregate shall meet requirements of D.O.T. Section 4109, Gradation No. 3, 4, or 5.
 - d. Maximum size of coarse aggregate: Not more than three-fourths minimum clear spacing between reinforcing bars and not more than one-fifth of smallest dimension of slab or member for which concrete is being used. Coarse aggregate for un-reinforced slabs maximum size one-third of slab thickness.
 2. Fine aggregate for concrete shall consist of clean, hard, durable mineral aggregate particles free from injurious amounts of silt, shale, coal, organic matter, or other deleterious material, and shall be from a source approved by Iowa D.O.T. The aggregate shall meet these requirements:
 - a. Gradation: Fine aggregate shall meet the requirements of D.O.T. Section 4109 for Gradation No. 1.
- C. Water: Water for concrete shall be clean, potable and free from injurious amounts of foreign matter.
- D. Water-Reducing Admixtures: ANSI/ASTM, C 494, Type A and contain not more than one percent (1%) chloride ions.
- "Eucon WR-74;" Euclid Chemical Co.
 "Pozzolith 322N;" Master Builders.
 "Plastocrete 160;" Sika Chemical Corp.
 "Chemtard;" Chem-Masters Corp. or approved equal
- E. Air-Entraining Admixture: ANSI/ASTM C 260, added to mixer in lieu of air-entrained cement.
- "Darex (AEA);" W. R. Grace Co.
 "Ad-Aire;" Carter-Waters Corp.
 "Protex AES;" Protex Industries, Inc.
 "Seal-Tight;" W. R. Meadows, Inc. or approved equal
- F. Liquid Membrane-Forming Curing Compound: Liquid type membrane-forming curing compound complying with ANSI/ASTM C 309, Type I, Class A unless other type acceptable to Project Engineer.
- "Masterseal;" Master Builders.
 "A-H 3 Way;" Sealer' Anti-Hydro Waterproofing Co.
 "Ecocure;" Euclid Chemical Co.
 "Clear Seal;" W. R. Grace.
 "Kure-N-Seal;" Sonneborn-Contech.
 "Polyclear;" Upco Chemical/USM Corp.
 "L & M Cure;" L & M Construction Materials.
 "LR-151;" Protex Industries.
 "Hardtop;" Gifford - Hill. or approved equal

1. Curing compound shall form a continuous unbroken membrane which shall adhere to moist concrete and which will not disintegrate, check or peel from the surface, nor show signs of such deterioration within 30 days after application under actual working conditions. The compound shall be sufficiently transparent and free from color so there will be no permanent change in the color of the concrete. The compound shall contain, however, a temporary dye of sufficient color to make the membrane clearly visible for a period of at least four hours after application.

2.03 EQUIPMENT:

- A. Batching, Mixing, and Delivery Equipment: Use transit-mixed concrete from approved batching and mixing plant. Batch, mix, and transport concrete to site in accordance with ANSI/ASTM 94.
- B. When air temperature is between 85°F. (30°C) and 90°F. (32°C), reduce mixing and delivery time from 1 1/2 hours to 75 minutes; and when air temperature is above 90°F. (32°C), reduce mixing and delivery time to 60 minutes.

2.04 ACCESSORIES:

- A. Pre-formed Joint Filler: ASTM D 994 and as herein specified.
 1. Pre-formed non-extruding resilient material, one-half (1/2) inch wide and of the depth required to bring surface to within one-half (1/2) inch of finished surface.
 2. Available Products: Subject to compliance with requirements, products that may be incorporated in the work include, but are not limited to, the following:
 - "Flexcell;" Celotex Corporation.
 - "Sealtight;" W. R. Meadows, Inc.
 - "Tex Mastic;" J & P Petroleum Products. or approved equal
- B. Joint Sealer: ASTM D-1850 Concrete Joint Sealer, cold-application type.
- C. Vapor Barrier: Under slabs on ground, 4 mil polyethylene film, when required by the Drawings.
- D. Storage: Store all cement materials in weather-tight enclosure, clear of ground, and protected from weather with suitable covering.
- E. Embedded Items: Verify and coordinate embedded items furnished by other trades.
- F. Keyways and/or Expansion Tubes: IDOT Section 4191, Series of 2001, or as required by the Drawings.
- G. Admixtures: Use air-entraining admixture in exterior exposed concrete, unless otherwise indicated as determined by ANSI/ASTM C 138. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having air content within following limits:
 1. Concrete structures and slabs exposed to freezing and thawing or subjected to hydraulic pressure:

<u>Maximum Size Aggregate</u>	<u>Amount of Air (%)</u>
1 1/2" or 2"	5% + 1%
3/4" or 1"	6% + 1%
3/8" or 1/2"	7 1/2% + 1%

2.05 MIXES:

- A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method used, use an independent testing facility acceptable to Project Engineer for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing unless otherwise acceptable to Project Engineer.
- B. Design mixes to provide normal weight concrete with the following properties, as indicated on drawings and schedules:
 - 1. 4,000 psi 28-day compressive strength; 624 lbs. cement per cubic yard minimum; W/C ratio, 0.488 maximum.
- C. Consistency: The quantity of water required for the proper consistency of concrete shall be determined by the slump test in accordance with ANSI/ASTM C 143. Slump allowances shall be as follows:
 - 1. Vertical Wall Sections, Columns -- Maximum slump, 4 inches, plus or minus one inch tolerance.
 - 2. Footings, Beams, Slabs -- Maximum slump, 3 inches, plus or minus one inch tolerance.

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.
- B. Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.

3.02 PREPARATION:

- A. Drain and pump all water from excavations, forms, and any locations where concrete is to be placed. Bottom of excavations shall be undisturbed earth free of frost or debris, level and compacted. Do not place any concrete until the DNR Construction Inspector has inspected and approved forms and soil conditions, and until reinforcing, sleeves, and embedded items have been placed. Clean all dirt and debris from transporting equipment. Clean reinforcement of all foreign matter. Clean forms and oil or wet (except in freezing conditions) surfaces. Compact, level, and dampen base fill material under slabs on grade. Prior to placing concrete, install polyethylene vapor barrier under interior slabs. Do not puncture or otherwise damage vapor barrier or membrane waterproofing.
- B. Transport concrete to prevent separation of materials in accordance with ACI practices. Do not add water to concrete during transporting. Handle from mixer to point of placement with carts, buggies, or conveyors. Do not dump concrete from mixer or from transporting equipment with a free fall of more than three feet. Deposit concrete as nearly to its final position as possible. Clean transporting equipment at frequent intervals during placement. Do not use partially hardened or contaminated concrete.

3.03 PLACEMENT OF CONCRETE:

- A. Place concrete in accordance with ACI 304 "Recommended practice for measuring, mixing, transporting and placing concrete" and as herein specified.

- B. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.
- C. Place concrete continuously so that fresh concrete is not placed against hardened concrete to form seams or planes of weakness. Work concrete into corners and around reinforcement. Machine vibrate sufficiently to insure thorough compaction and complete embedment of reinforcing. Stop placement at point of no shear, or where directed, and erect tight, plumb dams through forms. Place concrete between construction joints in one continuous operation. Locate construction joints in slabs under partitions. Brush on neat cement when pouring against hardened concrete.
- D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
 - 1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.
 - 2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least six (6) inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.
- E. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
 - 1. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Bring slab surfaces to correct level with straight edge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
 - 3. Maintain reinforcing in proper position during concrete placement operations.
- F. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306, "Cold Weather Concreting," and as herein specified.
 - 1. When air temperature has fallen to or is expected to fall below 40°F. (4°C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 40°F. (4°C), and not more than 80°F. (27°C) at point of placement, and maintain minimum temperature over the entire work for no less than 72 hours.
 - a. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - b. Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

- G. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305, "Hot Weather Concreting," and as herein specified:
1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90°F. (32°C). Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated in total amount of mixing water.
 2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
 3. Wet forms thoroughly before placing concrete.
 4. Use water-reducing retarding admixture (Type A) when required by high temperatures, low humidity, or other adverse placing conditions.
- H. Construction Joints: Contractor to submit placement and type of construction joints to Project Engineer for review prior to placement of any concrete on the project.
- I. Expansion Joints: Install expansion joint filler where interior slabs abut exterior walls, interior bearing walls and columns, at perimeter of concrete equipment pads, and other necessary locations as determined by the inspector. Omit expansion joint filler and install 15 lb. felt, centered below doors, to break bond at exterior doors with concrete platforms, unless otherwise shown on the Drawings.
- J. Construction Joints: When placing of concrete in any section of a structure must be interrupted, a construction joint shall be located as shown on the drawings in a manner that will not impair the strength or appearance of the structure, or as approved by the Engineer. The surface of the concrete in horizontal joints, except in the area near the form, shall be left rough to increase the bond with concrete that is to be placed later. Keyways shall be embedded not less than 1 ½ inches by 3 inches into the surface of the concrete. Construction joints shall be located in planes perpendicular to the principal lines of stress and at points designated by the Engineer.
- K. Control Joints: Cut control joints in all exposed concrete slabs on grade, as directed by the Inspector. Locate in a uniform pattern throughout parking areas. Verify location and cut to depth of one-sixth (1/6) of slab thickness with minimum of three-fourths (3/4) inch depth. Cut with carborundum saw, approximately six (6) to twenty-four (24) hours after placing concrete and when a minimum amount of raveling occurs in concrete.
1. On exterior walks, score with one-fourth inch by one inch (1/4" x 1") deep control joints. Use straight edge guide when scoring joints. Where required depth of control joint cannot be made by scoring, cut joints with carborundum saw.

3.04 CONCRETE FINISHING:

- A. Finish on Formed Surfaces: All finished or formed surfaces shall conform accurately to the shape, alignment, grades and sections as shown on the Drawings. Surfaces shall be free from fins, bulges, ridges, offsets, honeycombing or roughness, and shall present a finished, continuous, hard surface. All sharp angles, where required, shall be rounded or beveled.
1. Rough Form Finish:
 - a. Provide as-cast rough form finish to formed concrete surfaces that are to be concealed in the finish work or by any other construction.

- b. Standard rough form finish shall be the concrete surface having the texture imparted by the form facing material used, with tie holes and defective areas repaired and patched, and all fins and other projections exceeding one-fourth inch (1/4") in height rubbed down or chipped off.
- 2. Smooth Form Finish:
 - a. Provide as-cast smooth form finish for formed concrete surfaces that are to be exposed to view, or that are to be covered with a coating material other than cement plaster applied directly to the concrete.
 - b. Produce smooth form finish by selecting form material to impart a smooth, hard, uniform texture and arranging them orderly and symmetrically with a minimum of seams.
 - c. Repair and patch defective areas with all fins and other projections completely removed and smoothed.
- B. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike off smooth and finish with a smooth troweled finish.
- C. Slab and Floor Finish: For all floor and flat roof surfaces and all exterior concrete floor, sidewalk and flat slab surfaces, the Contractor shall be particularly careful to provide an adequate slope to the drains or to suitable points of disposal. The direction of slope and the amount of crowning generally are shown on the Drawings; otherwise, they shall be as prescribed by the Project Engineer or the DNR Construction Inspector. Dry topping will not be allowed on any of the finishes.
 - 1. Scratch Finish:
 - a. Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds for tile and other bonded applied cementitious-finish flooring material.
 - b. After placing slabs, plane the surface to a tolerance not exceeding one-fourth inch (1/4") in twenty-four inches (24") when tested with a straight edge.
 - c. Slope surfaces uniformly to drains where required.
 - d. After leveling, roughen the surface before the final set by using stiff broom brush or rake.
 - 2. Float Finish:
 - a. Apply float finish to monolithic slab surfaces that are to receive trowel finish and other finishes hereinafter specified, and to slab surfaces which are to be covered with insulation, and as otherwise shown on the Drawings or in the schedules.
 - b. After placing concrete slabs, do not work the surface further until ready for floating.
 - c. Begin floating when the surface water has disappeared and when the concrete has stiffened sufficiently to permit operation of a power-driven float, hand float, or both.
 - d. Consolidate the surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units.

- e. Check and level the surface plane to a tolerance not exceeding one-fourth inch (1/4") in ten feet (10'-0") when tested with a ten-foot (10'-0") straight edge placed on the surface at not less than two different angles.
 - f. Cut down high spots and fill low spots, uniformly slope surfaces to drains where required.
 - h. Immediately after leveling, re-float the surface to a uniform, smooth, granular texture.
3. Trowel Finish:
- a. Apply trowel finish to monolithic slab surfaces that are to be exposed to view, unless otherwise shown, and to slab surfaces that are to be covered with resilient flooring, carpeting, paint, or other thin-film finish coating system.
 - b. After floating, begin the first trowel finish operation using a power-driven trowel. Begin final troweling when the surface produces a ringing sound as the trowel is moved over the surface.
 - c. Consolidate the concrete surface by the final hand troweling operation, free from trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding one-eighth inch (1/8") in ten feet (10'-0") when tested with a ten-foot (10'-0") straight edge.
 - d. Grind smooth those surface defects which would telegraph through applied floor covering system.
4. Coordinate the required finish with the Project Engineer or DNR Construction Inspector prior to the application.

3.05 CONCRETE CURING:

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- 1. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than seven (7) days.
 - 2. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least seven (7) days in accordance with ACI 308, "Standard Practice for Curing Concrete." Avoid rapid drying at end of final curing period.
- B. Curing Method: Perform curing of concrete by moist curing, by moisture-retaining cover curing, by curing compound, and by combinations thereof as herein specified.
- 1. Provide moisture curing by the following methods:
 - a. Keep concrete surface continuously wet by covering with water.
 - b. Continuous water-fog spray.
 - c. Covering concrete surface with specified absorbent cover, thoroughly saturating cover with water and keeping continuously wet. Place absorbent cover to provide coverage of concrete surfaces and edges, with four-inch (4") lap over adjacent absorbent cover.
 - 2. Provide moisture-cover curing as follows: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least three

inches (3") and sealed by waterproof tape or adhesive. Immediately repair any holes and tears during curing period using cover material and waterproof tape.

3. Provide curing compounds for slabs as follows: Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within two (2) hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Re-coat areas subjected to heavy rainfall within three (3) hours after initial application. Maintain continuity of coating and repair damage during curing period.
4. Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring, painting, and other coatings and finish materials, unless otherwise acceptable to the coating manufacturer.

3.06 MISCELLANEOUS CONCRETE ITEMS:

- A. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as herein specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.
- B. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on the Drawings or required for the machine and equipment actually furnished. Set anchor bolts for machines and equipment to template, at correct elevations, complying with certified diagrams or templates of the manufacturer furnishing the machines and equipment. Provide isolation joints surrounding bases where indicated or required.

3.07 FIELD QUALITY CONTROL:

- A. Test of Materials and Installed Work: Materials and installed work may require testing and re-testing, as directed by Project Engineer, at any time during progress of work. Allow free access to material stockpiles and facilities. Tests, not specifically indicated to be done at Owner's expense, including re-testing of rejected materials and installed work, shall be done at Contractor's expense.
 1. Slump Tests: Take one slump test for each 10 cubic yards, or as directed by Project Engineer, of concrete placed at one operation in accordance with ASTM C 143. Keep job record of test results and location.
 2. Control Tests: During placement of concrete, take three standard 6" test cylinders in accordance with ACI 318-63 and ASTM C 31 for each type of concrete used. Test one at seven (7) days and one at twenty-eight (28) days. Take one set for every 20 cubic yards and any fraction with a minimum of one set of three cylinders for each day's pour. Tag cylinders to show date and location of test cylinder. Have compressive strength tests made by independent laboratory and results sent directly to Project Engineer. Hold remaining cylinders in case of breakage. Should retention at job site delay testing beyond seven (7) days, fourteen (14) day test is acceptable. Keep test cylinders shaded and damp until sent to laboratory.

3.08 REMEDIAL WORK:

- A. General: Reinforce or replace deficient work as directed by the Project Engineer or DNR Construction Inspector and at no additional cost to the Owner.
- B. Patching: Repair defective areas and fill form-tie holes and similar defects in accordance with ACI 301. Where, in the opinion of the DNR Construction Inspector, surface defects such as honeycomb occur, repair the defective areas as directed by the Project Engineer or DNR Construction Inspector.

3.09 PROTECTION OF CONCRETE CONSTRUCTION:

- A. All surfaces shall be protected against injury. During the first 72 hours after placing the concrete, any wheeling, working or walking on the concrete shall not be permitted. All slabs subject to wear shall be covered with a layer of sand or other suitable material as soon as the concrete has set. Sisalcraft paper or other similar tough waterproof paper may also be used, provided all joints between adjacent strips of paper are carefully sealed. This does not alter the requirements for proper curing.
- B. Do not place concrete slabs or top surfaces of walls during rain unless acceptable protective shelter is provided; and during such weather, all concrete placed within the preceding 12 hours shall be protected with waterproof canvas or other suitable coverings. These shall be provided and kept ready at hand.
- C. All concrete construction shall be protected from excessive loading. Installation of mechanical and electrical equipment shall be accomplished by employing shores, bearing plates, frames, cranes and temporary beams.

END OF SECTION 03300