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SECTION 32 11 23
AGGREGATE BASE COURSE

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SECTION 32 11 23
AGGREGATE BASE COURSE

PART 1 – GENERAL

1.01 SECTION INCLUDES

Aggregate base course.

1.02 RELATED SECTIONS

- A. Section 0145 00 - Quality Control.
- B. Section 31 00 00 - Earthwork
- C. Section 32 12 16 ga - Asphaltic Concrete Binder/Surface Courses: Binder and finish asphalt courses.

1.03 MEASUREMENT AND PAYMENT

Aggregate Base Course: Payment will be included in the contract lump sum price. Payment will include supplying all material, labor, and equipment, stockpiling, scarifying substrate surface, placing where required, and compacting.

1.04 REFERENCES (LATEST REVISION)

- A. ASTM C 131 – Resistance to Degradation of Small-Size Course Aggregate by Abrasion and Impact in the Los Angeles Machine.
- B. ASTM D 1557 – Laboratory Compaction Characteristics of Soil Using Modified Effort.
- C. ASTM D 2922 – Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- D. ASTM D 6938 – In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
- E. ASTM D 3740 – Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock Used in Engineering Design and Construction.
- F. ASTM E 329 – Agencies Engaged in Construction Inspection and/or Testing.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with the Georgia Department of Transportation 2013 Standard Specifications for Highway Construction.
- B. Source Quality Control Measures:

1. Perform tests necessary to locate acceptable source of materials meeting specified requirements.
2. Final approval of aggregate material will be based on test results of installed materials.
3. Should separation of coarse from fine materials occur during processing or stockpiling, immediately change methods of handling materials to correct uniformity in grading.

1.06 TESTING

- A. Laboratory tests for moisture density relationship for fill materials shall be in accordance with ASTM D 1557, (Modified Proctor).
- B. In place density tests in accordance with ASTM D 1556 or ASTM D 2922.
- C. Testing laboratory shall operate in accordance with ASTM D 3740 and E 329 and be acceptable to the Engineer.
- D. Testing laboratory and Project Engineer/Project Representative shall be given a minimum of 48 hours notice prior to taking any tests.
- E. Owner shall select and engage the Testing Laboratory. Testing Laboratory shall be responsible to the Owner and Owner's Engineer. Payment for laboratory and all tests shall be by the Owner, except Owner specifically reserves the right to deduct from Contractor's payment, expenses and charges of Testing Laboratory when:
 1. Contractor gives notice the work is ready for inspection and testing, and fails to be ready for the test, and/or
 2. Testing of the Contractor's work, products, or materials fail, and retesting is required, and/or
 3. Contractor abuses the services or interferes with the work of the testing laboratory in the conduct of this work.
- F. Test results shall be furnished to the Engineer prior to continuing with associated or subsequent work.

1.07 SUBMITTALS

- A. Informational Submittals
 1. Certified Test Results on Source Materials: Submit copies from commercial testing laboratory 20 days prior to delivery of materials to Project showing materials meeting the physical qualities specified.
 2. Certified results of in-place density tests from independent testing agency.

PART 2 – PRODUCTS

2.01 MATERIALS

Aggregate shall consist of processed and blended crushed stone. Aggregates shall be free from lumps and balls of clay, organic matter, objectionable coatings, and other foreign material and shall be durable and sound. Coarse aggregate shall have a percentage of wear not to exceed 65% after 500 revolutions as determined by ASTM C 131. Aggregate shall meet applicable requirements of Section 305.2 in the Georgia Department of Transportation Standard 2013 Specifications for Highway Construction. Material shall meet the following gradation and other requirements:

Granite Stone or Recycled Concrete	
Sieve Size	Percent by Weight Passing
2"	100
1-1/2"	95 - 100
1"	70 - 100
1/2"	48 - 75
# 4	30 - 60
# 30	11 - 30
#200	0 - 12
Liquid Limit	0 to 25
Plasticity Index	0 to 6

2.02 EQUIPMENT

- A. Equipment shall be in accordance with the Georgia Department of Transportation Standard 2013 Specifications for Highway Construction.
- B. Compaction Equipment: Adequate in design and number to provide compaction and to obtain specified density for each layer.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify subbase has been tested, is dry, and slopes and elevations are correct.
- B. ON SITE OBSERVATIONS OF WORK: The Owner's Representative or Engineer will have the right to require any portion of the work be completed in their presence and if the work is covered up after such instruction, it shall be exposed by the Contractor for observation at no additional cost to the Owner. However, if the Contractor notifies the Owner such work is scheduled, and the Owner or Engineer fails to appear within 72 hours, the Contractor may proceed. All work completed and materials furnished shall be subject to review by the Owner, Engineer or Project Representative. Improper work shall be reconstructed, and all materials, which do not conform to the requirements of the specifications, shall be removed from the work upon notice being received from the Engineer for the rejection of such materials. Engineer shall have the right to mark rejected materials to distinguish them as such.
- C. Contractor shall give the Owner, Project Engineer or Project Representative a minimum of 72 hours notice for all required observations or tests.

3.02 PREPARATION

- A. Subbase shall be graded and shaped conforming to the lines, grades, and cross sections required and cleaned of all foreign substances prior to constructing base course. Do not place base on soft, muddy or frozen surfaces. Correct irregularities in subbase slope and elevation by scarifying, reshaping, and recompacting.
- B. At the time of base course construction, subbase shall contain no frozen material.
- C. Surface of subbase shall be checked by the Engineer or Project Representative for adequate compaction and surface tolerances. Ruts or soft yielding spots appearing in areas of subbase course having inadequate compaction, and areas not smooth or which vary in elevation more than 3/8-inch above or below required grade established on the plans, shall be corrected to the satisfaction of the Engineer or Project Representative. Base material shall not be placed until subbase has been properly prepared and test results have so indicated.
- D. Obtain Engineer's acceptance of subgrade before placing base course or surfacing material.
- E. Hauling:
 - 1. Do not haul over surfacing in process of construction.
 - 2. Loads: Of uniform capacity.
 - 3. Maintain consistent gradation of material delivered; loads of widely varying gradations will be cause for rejection.

3.03 AGGREGATE PLACEMENT

- A. Aggregate shall be placed in accordance with Georgia Department of 2013 Transportation Standard Specifications for Highway Construction Section 305 and in accordance with these specifications.
- B. Maximum lift thickness of Aggregate Base Course shall be six (6) inches. Maximum lift thickness of Gravel Surfacing shall be nine (9) inches. Place and compact each lift to required density before succeeding lift is placed.
- C. Distribute material to provide required density, depth, grade, and dimensions with allowance for subsequent lifts.
- D. Produce even distribution of material upon roadway or prepared surface without segregation. Should segregation of coarse from fine materials occur during placing, immediately change methods of handling materials to correct uniformity in grading.
- E. Level and contour surfaces to elevations and slopes indicated on the Drawings.
- F. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.
- G. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.
- H. Use mechanical tamping equipment in areas inaccessible to compaction equipment.
- I. While at optimum moisture ($\pm 1-1/2\%$), compact base course with rollers capable of obtaining required density. Vibratory, flatwheel, and other rollers accepted by the Engineer may be used to obtain required compaction. Rolling shall continue until base is compacted to 100% of the modified Proctor maximum laboratory dry density as determined by ASTM D 1557. In-place density of the compacted base shall be determined in accordance with ASTM D 2922.
- J. Base shall be allowed to cure at least 15 days after the acceptable completion tests are achieved before paving.

3.04 TOLERANCES

- A. Flatness: Maximum variation of 1/4 inch measured with an acceptable 10-foot straight edge.
- B. Scheduled Compacted Thickness: Within 3/8 inch.
- C. Variation from Design Elevation: Within 3/8 inch.
- D. Depth measurements for compacted thickness shall be made by test holes through the base course. Where base course is deficient, correct such areas by scarifying, adding base material and recompacting as directed by the Engineer.

3.05 FIELD QUALITY CONTROL

- A. Density and moisture testing will be performed in accordance with ASTM D 1557, ASTM D 2922, and ASTM D 6938.
- B. See Table below for minimum sampling and testing requirements for aggregate base course and surfacing:

Minimum Sampling and Testing Requirements			
Property	Test Method	Frequency	Sampling Point
Gradation	AASHTO T11 and AASHTOT27	One sample every 500 tons but at least every 4 hours of production	Roadbed after processing
Moisture Density (Maximum Density)	AASHTO T180, Method D	One test for every aggregate grading produced	Production output of stockpile
In-place Density and Moisture Content	AASHTO T310 and AASHTO T265 for moisture content	One for each 500 ton but at least every 10,000 sq ft of area	In-place completed, compacted area

- C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest.
- D. Frequency of Tests:
Base Density and Thickness - One test per 5,000 square feet.

END OF SECTION

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SECTION 32 12 16GA
ASPHALT PAVING

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SECTION 32 12 16GA**ASPHALT PAVING****PART 1 – GENERAL****1.01 SECTION INCLUDES**

- A. Surface Course
- B. Binder Course

1.02 RELATED SECTIONS

- A. Section 01 45 00 – Quality Control
- B. Section 31 23 13 – Subgrade Preparation
- C. Section 31 23 23 – Fill and Backfill
- D. Section 32 11 23 – Aggregate Base Courses

1.03 OMITTED**1.04 REFERENCES (LATEST REVISION)**

- A. ASTM D 946 – Penetration-Graded Asphalt-Cement for Use in Pavement Construction.
- B. ASTM E 329 – Agencies Engaged in Construction Inspection and/or Testing.
- C. ASTM D 3740 – Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock Used in Engineering Design and Construction.
- D. ASTM D 2726 – Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures.
- E. ASTM D 2950 – Density of Bituminous Concrete in Place by Nuclear Methods.
- F. ASTM D 1188 – Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples.
- G. ASTM D 1754 – Effect of Heat and Air on Asphaltic Materials (Thin-film Oven Test).

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with Georgia Department of Transportation 2013 Standard Specifications for Highway Construction.
- B. Mixing Plant: Conform to Georgia Department of Transportation 2013 Standard Specifications for Highway Construction.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Do not place asphalt mixture when ambient air temperature is less than that indicated in the Table nor when the surface is wet or frozen.

Lift Thickness	Min. Air Temperature, Degrees F.
1" or Less	55
1.1" to 2"	45
2.1" to 3"	40
3.1" to 4.5"	35

- B. Mixture shall be delivered to the spreader at a temperature between 250 degrees F and 325 degrees F.

1.07 GUARANTEE

- A. Contractor shall guarantee the quality of materials, equipment, and workmanship for a period of 12 months after acceptance. Defects discovered during this period shall be repaired by the Contractor at no cost to the Owner.

1.08 TESTING

- A. Testing laboratory shall operate in accordance with ASTM D 3740 and E 329 and be acceptable to the Engineer.
- B. Testing laboratory and Project Engineer/Project Representative shall be given a minimum of 48 hours notice prior to taking any tests.
- C. Owner shall select and engage the testing laboratory. Testing laboratory shall be responsible to the Owner and Owner's Engineer. Payment for laboratory and all tests shall be by the Owner, except Owner specifically reserves the right to deduct from Contractor's payment, expenses and charges of testing laboratory when:
 1. Contractor gives notice the work is ready for inspection and testing, and fails to be ready for the test, and/or
 2. Testing of the Contractor's work, products or materials fail, and retesting is required, and/or
 3. Contractor abuses the services or interferes with the work of the testing laboratory in the conduct of this work.

- D. Test results shall be furnished to the Engineer prior to continuing with associated or subsequent work.

PART 2 – PRODUCTS

2.01 TACK COAT

- A. Shall consist of asphalt binder (asphalt cement) or emulsified asphalt, conforming to Section 401 of the Georgia Department of Transportation 2013 Standard Specifications for Highway Construction. Asphalt binder shall be PG64-22. The acceptable grades of emulsified asphalt are RS-1, MS-1, MS-2, HFMS-1, HFMS-2, SS-1, CRS-1, CRS-2, CMS-2, and CSS-1.

2.02 ASPHALT BINDER AND ADDITIVES

- A. Shall be PG64-22 and conform to Section 401 of the Georgia Department of Transportation 2013 Standard Specifications for Highway Construction.
- B. Anti-Stripping: Shall conform to requirements of Section 401 of the Georgia Department of Transportation 2013 Standard Specifications for Highway Construction.

2.03 AGGREGATES

- A. General: Mineral aggregate shall be composed of fine aggregate or a combination of fine and coarse aggregate. Coarse aggregate shall be that portion of the material retained on a No. 4 sieve.

Fine aggregate shall be considered that portion passing the No. 200 sieve. Fine aggregate, coarse aggregate, and any additives in combination with the specified percentage of asphalt cement shall meet the requirements of tests specified, before acceptance may be given for their individual use. Marine (Fossiliferous) limestone shall not be used.

- B. Fine Aggregate: Shall conform to the requirements of Section 401 of the Georgia Department of Transportation Standard Specifications for Highway Construction.
- C. Coarse Aggregate: Shall be granite stone and conform to the requirements of Section 401 of the Georgia Department of Transportation 2013 Standard Specifications for Highway Construction.
- D. Surface Course: The surface course shall consist of fine and coarse aggregate and mineral filler uniformly mixed with hot asphalt binder in an acceptable mixing plant. The plant shall conform to Georgia Department of Transportation 2013 Standard Specifications for Highway Construction. The gradations, asphalt content and air voids shall be the following:

TYPE C	
Square Sieve	% Passing
3/4 inch	100
1/2 inch	97 - 100
3/8 inch	83 - 100
No. 4	58 - 80
No. 8	42 - 62
No. 30	20 - 40
No. 100	8 - 20
No. 200	3 - 9
% Asphalt Binder	5.0 - 6.8
Air Voids, %	3.5 - 4.5

- E. Intermediate or Binder Course: The mineral aggregates and asphalt binder shall be combined in such proportions the composition by weight of the finished mixture shall be within the following range limits:

TYPE B	
Sieve Designation	Percentage by Weight Passing
1 inch	100
3/4 inch	90 - 100
1/2 inch	75 - 90
3/8 inch	64 - 80
No. 4	38 - 54
No. 8	22 - 36
No. 30	8 - 22
No. 100	3 - 10
No. 200	2 - 8
% Asphalt Binder	4 - 6
Air Voids, %	- 4.5

2.04 SOURCE QUALITY CONTROL AND TESTS

- A. Section 01 45 00 - Quality Control.
- B. Submit proposed mix design for review prior to beginning of work.
- C. Test samples in accordance with the requirements of these specifications.

PART 3 – EXECUTION**3.01 EXAMINATION**

- A. On-Site Observations: Owner's Representative or Engineer will have the right to require any portion of work be completed in their presence. If work is covered up after such instruction, it shall be exposed by the Contractor for observation at no additional cost to Owner. However, if Contractor notifies Engineer such work is scheduled, and Engineer fails to appear within 48 hours, the Contractor may proceed. All work completed and materials furnished shall be subject to review by the Engineer or Project Representative. Improper work shall be reconstructed. All materials, which do not conform to requirements of specifications, shall be removed from the work upon notice being received from Engineer for rejection of such materials. Engineer shall have the right to mark rejected materials to distinguish them as such.

Contractor shall give the Owner, Project Engineer or Project Representative a minimum of 48 hours notice for all required observations or tests.

- B. Contractor shall verify base has been tested, is dry, and slopes and elevations are correct.

3.02 PREPARATION

- A. Apply tack coat in accordance with Section 401 of the South Carolina Department of Transportation 2007 Standard Specifications for Highway Construction. Rate of application shall be 0.05 to 0.15 gallons per square yard of surface.
- B. Work shall be planned so no more tack coat than is necessary for the day's operation is placed on the surface. All traffic not essential to the work should be kept off the tack coat.
- C. Apply tack coat to contact surfaces of curbs and gutters. Apply in manner so exposed curb or gutter surfaces are not stained.
- D. Coat surfaces of manhole frames and inlet frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

3.03 PLACEMENT

- A. Construction shall be in accordance with Sections 401, 402, and 403 of the Georgia Department of Transportation 2013 Standard Specifications for Highway Construction.
- B. Asphaltic concrete shall not be placed on a wet or frozen surface.

- C. Compaction shall commence as soon as possible after the mixture has been spread to the desired thickness. Compaction shall be continuous and uniform over the entire surface. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks. Compaction rolling shall be complete before material temperature drops below 175° F.
- D. Areas of pavement with deficient thickness or density shall be removed and replaced at no additional cost to the Owner.

3.04 TOLERANCES

- A. General: All paving shall be subject to visual and straightedge evaluation during construction operations and thereafter prior to final acceptance. A 10-foot straightedge shall be maintained in the vicinity of the paving operation at all times for the purpose of measuring surface irregularities on all paving courses. The straightedge and labor for its use shall be provided by the Contractor. The surface of all courses shall be checked with the straightedge as necessary to detect surface irregularities. Irregularities such as rippling, tearing or pulling, which in the judgment of the Engineer indicate a continuing problem in equipment, mixture or operating technique, will not be permitted to recur. The paving operation shall be stopped until appropriate steps are taken by the Contractor to correct the problem.
- B. Flatness: All irregularities in excess of 1/8 inch in 10 feet for surface courses and 1/4 inch in 10 feet for intermediate courses shall be corrected.
- C. Variation from Design Elevation:
 - 1. General Paving: Less than 1/4 inch.
 - 2. Accessible Routes: Shall not exceed 1/4 inch. However, accessible routes shall not exceed maximum ADA allowable slopes. Contractor shall remove and replace any and all portions of the accessible route that exceed maximum ADA allowable slopes.
- D. Scheduled Compacted Thickness: Within 1/4 inch per lift.
- E. Pavement Deficient in Thickness: When measurement of any core indicates the pavement is deficient in thickness, additional cores will be drilled 10 feet either side of the deficient core along the centerline of the lane until the cores indicate the thickness conforms to the above specified requirements. A core indicating thickness deficiencies is considered a failed test. Pavement deficient in thickness shall be removed and replaced with the appropriate thickness of materials. If the Contractor believes the cores and measurements taken are not sufficient to indicate fairly the actual thickness of the pavement, additional cores and measurements will be taken, provided the Contractor will bear the

extra cost of drilling the cores and filling the holes in the roadway as directed.

3.05 FIELD QUALITY CONTROL

- A. Acceptance of the in-place density of the binder and surface courses shall be in accordance with the Georgia Department of Transportation 2013 Standard Specifications for Highway Construction.
- B. Density Testing: Performed in accordance with ASTM D-2726 and ASTM D-2950. Core samples for each day's operation shall be taken, tested and results reported to the Engineer the following day. The areas sampled shall be properly restored by the Contractor at no additional cost to the Owner. Nuclear gauge tests shall be taken during the asphaltic concrete placement.
 - 1. The pavement core and nuclear gauge densities shall range between 94% and 96% of the theoretical maximum laboratory density.
- C. Temperature:
 - 1. Asphaltic concrete shall not exceed 325 degrees F at any time.
 - 2. Asphaltic concrete shall not be placed once the temperature of the mix falls below 250 degrees F or the delivered temperature is more than 15 degrees F below the batch plant's delivery ticket.
 - 3. Temperature at time of loading shall be recorded on the truck delivery ticket.
- D. Frequency of Tests:
 - 1. Asphaltic Concrete – One test for each 250 tons placed.
 - a. Asphalt extraction and gradation test.
 - b. Core Sample
 - 2. Field determination of density by nuclear method every 5,000 square feet during construction of the asphaltic concrete binder/surface course.

END OF SECTION

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Section 32 31 18**CHAIN LINK FENCING AND ELECTRIC GATES****PART 1 – GENERAL****1.01 WORK INCLUDED**

- A. Furnish and install chain link fence around the entire site as shown on the Drawings. Fencing to include one manual personnel gate, one electric operated vehicular gates, one manual vehicular gate and all necessary materials, equipment and accessories.
- B. Furnish and install a complete microprocessor based vehicular swing gate operators system, with a solid-state board to control all functions of the swing operator, as described herein and shown on the Drawings. Include all necessary boards, power supplies, special mounting hardware, connectors and accessories for a complete operational system.
- C. Furnish and install one (1) electric access key pads at the electric operated vehicular gates.

1.02 CONTRACT DOUCMENTS

- A. All equipment and work specified in this section shall comply, with all General Conditions of the specifications, contract documents and Drawings as indicated.

1.03 RELATED WORK

- A. Contractor is responsible for the complete installation of all fencing and electric gates.
- B. Contractor is responsible for the complete installation of all necessary electrical and controls prior to paving of the plant entrance road of the plant site roads.

1.04 QUALITY ASSURANCE

- A. Installation shall comply with all applicable codes.
- B. All equipment shall be new, in current production, and the standard products of a manufacturer of polymer Coated Steel Fabric ASTM F668. Metallic coated steel core wire Class 2b fused and adhered black color in compliance with ASTM F934.
- C. Manufacturer shall guarantee availability of parts, for a minimum of seven (7) years from date of acceptance of installation.

- D. Manufacturer is shall demonstrate features, functions, and operating characteristics to the Owner prior to acceptance of installation.
- E. Fencing system shall be installed by a factory trained authorized contractor who has sold, installed, maintained and serviced this type of system for at least five (5) years, and who employs technicians specifically trained in this system.
- F. On-site maintenance and repair service shall be available locally 24 hours per day, 7 days per week, and within four (4) hours of notification for emergency condition.

1.05 REFERENCED STANDARDS

- A. Vehicular Swing Gate Operator shall be in compliance with the Underwriter Laboratories Inc. (UL) Standard for Safety — Door, Drapery, Gate, Louver and Window Operators and Systems, UL 325 Fourth Edition; and Underwriter Laboratories Inc. (UL) Standard for Safety — Tests for Safety-Related Controls Employing Solid-State Devices, UL 991 Second Edition.
- B. Vehicular Swing Gate Operator shall be tested for compliance to the UL 325 and UL 991 and shall be LISTED by the Nationally Recognized Testing Laboratory (NRTL).

1.06 SUBMITTALS

- A. Provisions: Submittals shall comply with the Submittal Procedure Section 01 33 00.
- B. Shall include an equipment list, data sheets, system description, block diagrams on equipment to be furnished and electrical wiring diagrams for installation.
- C. Shall include all data necessary to evaluate design, quality and configuration of the proposed equipment and system(s).

1.07 WARRANTY

- A. Systems shall include a factory warranty that equipment is free from defects in design, material, manufacturing and operation.
- B. Factory warranty period shall be for two (2) years parts and workmanship; 24months from date of acceptance of installation.
- C. Contractor shall guarantee the equipment, wire and installation for 12-months from the date of acceptance of installation.

PART 2 – PRODUCTS

2.01 FENCING AND GATES

- A. Fencing shall have an overall height of 8 feet (seven-foot-tall fabric with three strands of barbed wire), standard FE security fence construction, 2 h" OD schedule 40 galvanized steel line posts, 3" OD schedule 40 galvanized steel termination and corner posts (for gate posts, see Part 1.1 B), installed in lengths, quantities, and locations as shown on the drawings.
- B. Gates
 - 1. Install one (1) 14 ft opening heavy-duty industrial gates in chain link fencing enclosure in the locations shown on the drawings. Gates shall be suitable for electric operation and vehicular traffic.
 - 2. Install one (1) 20 ft opening heavy-duty industrial double gate in chain link fencing enclosure in the location shown on the drawings. Gate shall be suitable for manual operation and vehicular traffic.

2.02 ELECTRICALLY OPERATED VEHICULAR GATE EQUIPMENT

- A. Gate Operators shall **be Door King Model 6300, 230 V, 1 ph, 0.5 hp** or equal with one master and one slave unit, for double-swing gates. Operator shall be equipped with post mount kit.
- B. Loop detectors shall be Door King electronic loop detectors designed for use with the microprocessor-based control board, one single-channel detector and one dual channel loop detector, or equal, for use with reversing, shadow, and free exit loops on a swing gate operated system.
- C. The swing gate shall be able to automatically set its own open and close limit settings.
- D. An adjustable timer shall be built into the control board to allow the gate to automatically close.
- E. A tamper detect function shall start the motor to re-close the gate if the gate is forced open without an authorized command.
- F. Master/Slave interconnect cable shall be Door King for connecting both high and low-voltage interconnections between the master and slave gate operators or equal.
- G. Vehicular Gate Operators shall be design for Class-I 11, Industrial/Limited Access operation.

- H. The gate operator shall be designed in such a way that if an obstruction is met during the opening or closing cycles, the gate operator will automatically reverse the gate. This reverse system shall be inherently designed into the operator so that if the external reverse devices fail or become inoperative, the operator will still sense the obstruction and reverse the gate.
- I. The inherent reverse system in the gate operator shall consist of a primary system that will reverse the gate if an obstruction is sensed. Should the primary system fail or become inoperative, a secondary inherent system will sense the obstruction and reverse the gate.
- J. The primary system shall sense a clutch slippage and reverse the gate. Should the clutch fail to slip, the secondary system will sense a stoppage and reverse the gate.
- K. The gate operator shall stop and activate the internal alarm upon sensing an entrapment (two sequential activations of the inherent sensing system) and shall require activation of the reset switch prior to returning to normal operation, as required by UL 325 safety standard.
- L. For enhanced safety, the operator shall upon sensing an entrapment, release pressure on the gate and assume a fail-safe condition to allow any entrapment the opportunity to free itself without the need of outside intervention.
- M. The gate operator shall incorporate a "fail-safe" design that will allow manual operation of the gate from either the inside or the outside without the need of any hand cranks, keys or other mechanical devices, as the primary manual release device.
- N. The manual release device shall be affixed to the operator and be capable of being quickly operated in an entrapment situation.
 - 1. The release must be an integral (non-removable) part of the operator.
 - 2. A single non-repetitive movement shall cause an action that will allow the gate to be manually operated.
 - 3. The manual release or manual operation of the gate shall not result in a risk of injury to persons if the operator is activated while the manual release is activated or being used.
- O. Swing gate operator shall be 16" wide, 31 " long, 12" high with post mounting kit.
- P. Loop detection shall be provided and plug into the main control board and prevent the gate from closing on vehicular traffic.
- Q. Contact edge sensors shall be provided to reverse the gate on contact with any object.

2.03 ELECTRICAL OPERATED GATE KEYPAD

- A. Furnish and install one (1) Door King Model 1506 100-Memory Illuminated Keypads or equal.
- B. Keypad shall be installed on a gooseneck stand with 12" sweep at 42" high.
- C. Keypad shall require 16-volt AC power, two form C dry contact relays, 30 V I amp maximum.
- D. Capacity shall be 100 4-digit codes, six 5-digit codes.
- E. Keypad shall be such that individual PINs can be added or deleted from the keypad and a "hold" code can be programmed to latch open the gate if needed for an extended period of time.

PART 3 – EXECUTION**3.01 INSTALLATION**

- A. Shall be installed by qualified technicians who have been factory trained and certified.
- B. Equipment shall be post mounted firmly secured, plumb and level.
- C. Wiring shall be uniform and in accordance with national electric codes and manufacturer's instructions.
- D. All splices shall be easily accessible junction boxes or on terminal boards. E. All cable runs in all junction boxes shall be tagged and identified.
- E. Coordinate all work with other effected trades and contractors.

3.02 SYSTEM INITIALIZATION AND PROGRAMMING

- A. System shall be turned on and adjustment made to meet requirements of specifications and onsite conditions. B. System shall function as specified.

3.03 SYSTEM TEST PROCEDURES

- A. System shall be completely tested to assure that all components, and accessories are hooked-up and in working order.
- B. System shall be pre-tested by contractor and certified to function in accordance with plans and specifications.
- C. System shall be tested in presence of owner's representative.

3.04 OWNER INSTRUCTIONS

- A. Contractor shall conduct up to four (4) hours of instruction in use and operation of the system to designated owner representatives, within thirty (30) days of acceptance of installation.
- B. Contractor shall conduct up to four (4) hours of technical training, in trouble shooting and service of the system, to designated owner representatives within thirty (30) days of acceptance of installation.

3.05 MANUALS AND DRAWINGS

- A. Contractor shall provide owner with six (6) copies of standard factory prepared operation, installation and maintenance manuals. Manuals shall include typical wiring diagrams.
- B. Contractor shall provide owner with six (6) copies of any risers, layouts, and special wiring diagrams showing any changes to standard drawings, if required on project.

3.06 MAINTENANCE

- A. The manufacturer recommends periodic maintenance at three-month intervals as described in the installation and maintenance manual.
- B. External reversing devices should be checked at least once a month.

END OF SECTION

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TURF AND GRASSES

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SECTION 32 92 00**TURF AND GRASSES****PART 1 – GENERAL****1.01 SECTION INCLUDES**

- A. Contractor to use established sod on all graded areas behind the structures, pipeline rights-of-way, roadway shoulders, slopes and other disturbed areas not covered with gravel, crusher run, concrete, or asphalt (except for Phase II area). Phase II designated area can be seeded and fertilized.
- B. Seed protection.
- C. Maintaining seeded areas until final acceptance.
- D. Irrigation system: Contractor shall provide a permanent irrigation system to water areas showing to be planted on the landscape sheets using plant reuse water. Submit design for approval. Use T010 or Rainbird Products.

1.02 IRRIGATION PIPING DESIGN WORK

contractor to submit to Engineer an irrigation design plan prepared by irrigation company. Design shall include piping size, spray head irrigation, valves, plans and specifications.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Deliver grass seed in original containers showing analysis of seed mixture, percentage of pure seed, year of production, net weight, date of packaging, and location of packaging. Damaged packages are not acceptable. Store in cool, dry locations away from contaminants.
- B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer. Damaged bags are not acceptable. Store in cool, dry locations away from contaminants.
- C. Deliver sod on pallets.
- D. All material shall be acceptable to Engineer prior to use.

1.04 PLANTING DATES

- A. This specification provides for establishment of a permanent grass cover between the dates of March 1 and September 30. If finished earth grades are not completed in time to permit planting and establishment of permanent grass during the favorable season between dates specified above unless otherwise accepted, Contractor will be required to plant a temporary cover to protect new graded areas from erosion and to keep windborne dust to a minimum. The temporary cover shall be planted between October 1 and February 28 unless otherwise permitted.

PART 2 – PRODUCTS

- A. Contractor shall submit source and species certification documents to Engineer and Owner's Representative for review prior to installation. Supply complete information on all analysis/test methodologies and results; laboratory certifications, manufacturer's specifications, and agency approvals to the Landscape Architect/Project Engineer prior to placement of soil mixtures. In addition, provide the Landscape Architect/Project Engineer with thoroughly mixed sample of soil mixes for acceptance prior to placement. Landscape Contractor shall make modifications and improvements to soil mixes deemed necessary by the soil analysis to meet requirements specified here in before, and to ensure proper growing medium for plant material.

2.01 SEED

- A. All seed shall conform to State Laws and requirements and regulations of the State Department of Agriculture.
- B. The varieties of seed, as specified in Section 2.2, shall be individually packaged or bagged, and tagged to show name of seed, net weight, origin, germination, lot number, and other information required by the State Department of Agriculture.
- C. Engineer reserves the right to test, reject, or accept all seed before seeding.

2.02 SEEDING SCHEDULE

A.	<u>SEED</u>	<u>RATE</u>	<u>PLANTING DATES</u>
	Bermuda	15-lbs/acre	March 1 – September 30
	Brown top millet	10-lbs/acre	
	Rye	40-lbs/acre	

2.03 FERTILIZER

- A. Commercial fertilizer of accepted type, conforming to State fertilizer laws at the rate as recommended by soils test.

2.04 LIME

- A. Agricultural grade, ground limestone at the rate as recommended by soils test.

2.05 SPRIG

- A. Healthy living stems, stolons, or rhizomes and attached roots of locally adapted grass without adhering soil, including two to three nodes and from 4 to 6 inches long. Obtain from heavy, dense certified sod. Provide sprigs which have been

grown under climatic conditions similar to those in the locality of project. Coordinate harvesting and planting operations to prevent exposure of sprigs to the sun for more than 30 minutes before covering and moistening. Sprigs showing signs of wilt, mold, containing weeds, or other detrimental material or are heat damaged will be rejected.

- B. Varieties of sprig, as specified in section 2.6, shall be individually packaged or bagged, and tagged to show name of sprig, net weight, origin, and other information required by the State Department of Agriculture.
- C. Sprigs shall be pure to variety specified and shall be free of other grass species, weeds or foreign matter.
- D. Sprigs shall be harvested by digging (not collected above soil level), shredding sod, rototilling sod and raking, vericutting, or with a sprig harvester. Sprigs shall consist of mostly rhizomes and crowns with only a few green leaves.

2.06 SPRIGGING SCHEDULE

- | A. | <u>SPRIG</u> | <u>RATE</u> | <u>PLANTING DATES</u> |
|----|--|---|---|
| | 'TifSport' Bermuda | 1,000 bushels/acre
(Maximum 12 week grow-in) | April 1 - August 31 |
| | Stabilize site with temporary grass seed | | September 1 - March 31
(See section 2.2) |
- B. In areas where existing grass is to be matched, Contractor shall sprig at the rate and dates recommended by sprig distributor.

2.07 SOD

- A. Sod shall be premium grade, densely rooted, good quality grass of the species and certified variety as shown on the plans, free from noxious weeds with no surface soil being visible. The sod shall be obtained from areas where the soil is reasonably fertile. Sod of specified species shall be grown from seed or sprig with not less than 95 percent germination, 85 percent pure seed, and not more than 0.5 percent weed seed. The sod shall be machine cut to a uniform soil thickness that shall contain practically all of the dense root system and not be less than 1-inch thick.
- B. Before cutting, sod shall be mowed to a height of not less than 1-1/2-inches or more than 2-inches. Sod shall be cut in minimum uniform widths of 12-inches and lengths of 24 inches.
- C. Sod shall be delivered to site in a fresh, moist condition with healthy green foliage. It shall be unloaded from delivery trucks on pallets or in rolls and placed in final position within 24 hours of delivery. Sod shall be protected from wind and sun and shall not be allowed to dry out before planting.
- D. Sod shall be strong enough to support its own weight and retain its size and shape when suspended vertically from a firm grasp on the upper 10 percent of the

section.

2.08 ACCESSORIES

- A. Straw Mulch: Oat or wheat straw, reasonably free from weeds, foreign matter detrimental to plant life, and in dry condition.
- B. Excelsior Mulch: Excelsior mulch shall consist of wood fibers cut from sound, green timber. The average length of fibers shall be 4 to 6 inches. Cut shall be made in such a manner as to provide maximum strength of fiber, but at a slight angle to natural grain of the wood to cause splintering of fibers when weathering in order to provide adherence to each other and to soil.
- C. Wood cellulose fiber shall be made from wood chip particles manufactured particularly for discharging uniformly on the ground surface when dispersed by a hydraulic water sprayer. It shall remain in uniform suspension in water under agitation and blend with grass seed and fertilizer to form a homogenous slurry. Mulch fibers shall intertwine physically to form a strong moisture holding mat on the ground surface and allow rainfall to percolate into underlying soil. The mulch shall be heat processed to contain no germination or growth-inhibiting factors. It shall be dyed (non-toxic) an appropriate color to facilitate metering of material.

2.09 TOPSOIL

- A. Topsoil shall be fertile, friable natural loam capable of sustaining vigorous plant growth. It shall be free of any admixture of subsoil, stones over 1-inch diameter, clods of hard earth, plants, roots, sticks or other extraneous material. It shall not be excessively acid or alkaline.

2.10 PRODUCT REVIEW

- A. Contractor shall provide the Engineer with a complete description of all products before ordering. The Engineer will review all products before they are ordered.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Areas to be seeded shall be made smooth and uniform and shall conform to the finished grade indicated on plans.
- B. Remove all foreign materials, plants, roots, stones, and debris from surfaces to be seeded.
- C. Grassing areas, if not loose, shall be loosened to a minimum depth of 3 inches before fertilizer, seed or sod is applied.
- D. Amendments to soils shall be incorporated into loosened 3-inch top soil layer as recommended by soils tests.

- E. Existing topsoil shall be stripped and stockpiled for future use in an area approved by the Owner. Contractor shall spread topsoil in all areas to have turf or grass. Contractor shall provide additional topsoil as needed at no additional cost.
- F. Contractor shall provide Topsoil Analysis Tests performed by a State Agricultural Experiment Station, Soil and Water Conservation District, State University, or other qualified private testing laboratory, as acceptable to Landscape Architect/Engineer. Soils test shall identify existing pH and nutrient levels, as well as recommended adjustments based on the type of grass to be installed.

3.02 STAND OF GRASS

- A. Before acceptance of seeding, sodding, or sprigging is performed for the establishment of permanent vegetation, Contractor will be required to produce a satisfactory stand of perennial grass whose root system shall be developed sufficiently to survive dry periods and winter weather and be capable of re-establishment in spring.
- B. Before acceptance of seeding is performed for the establishment of temporary vegetation, Contractor will be required to produce a stand of grass sufficient to control erosion for a given area and length of time before the next phase of construction or establishment of permanent vegetation is to commence.

3.03 SEEDING AND SPRIGGING DATES

- A. Seeding and sprigging shall be performed during periods and at rates specified in their respective schedules. Seeding and sprigging work may, at discretion of Contractor, be performed throughout the year using schedule prescribed for given period. Seeding and sprigging work shall not be conducted when the ground is frozen or excessively wet. Contractor will be required to produce a satisfactory stand of grass regardless of the period of year work is performed.

3.04 APPLYING LIME AND FERTILIZER

- A. Following advance preparation and placing selected material for shoulders and slopes, lime and fertilizer, if called for based on soil tests, shall be spread uniformly over the designated areas, and shall be thoroughly mixed with the soil to a depth of approximately 2 inches. Fertilizer and lime shall be applied at the rate recommended by required soils test. Unless otherwise provided, lime will not be applied for temporary seeding. In all cases where practicable, acceptable mechanical spreaders shall be used for spreading fertilizer. On steep slopes subject to slides and inaccessible to power equipment, the slopes shall be adequately scarified. Fertilizer may be applied on steep slopes by hydraulic methods as a mixture of fertilizer and seed. When fertilizer is applied with combination seed and fertilizer drills, no further incorporation will be necessary. The fertilizer and seed shall be applied together when Wood Cellulose Fiber Mulch is used. Any stones larger than 2-1/2 inches in any dimension, larger clods, roots, or other debris brought to the surface shall be removed.

3.05 SEEDING

- A. Seed shall be sown within 24 hours following application of fertilizer and lime and preparation of the seedbed as specified in Section 3.4. Seed shall be uniformly sown at rate specified by the use of acceptable mechanical seed drills. Rotary hand seeders, power sprayers or other satisfactory equipment may be used on steep slopes or on other areas inaccessible to seed drills.
- B. Seeds shall be covered and lightly compacted by means of cultipacker or light roller if the drill does not perform this operation. On slopes inaccessible to compaction equipment, the seed shall be covered by dragging spiked chains, by light harrowing or by other satisfactory methods.
- C. Apply water with fine spray immediately after each area has been sown.
- D. Do not sow seed when ground is too dry, during windy periods or immediately following a rain.
- E. If permitted by the special provisions, wood cellulose fiber mulch or excelsior fiber mulch may be used.

3.06 SEED PROTECTION (STRAW MULCH)

- A. All seeded areas seeded with permanent grasses shall be uniformly mulched in a continuous blanket immediately following seeding and compacting operations, using at least 2 tons of straw per acre.

3.07 SEED PROTECTION (EXCELSIOR MULCH)

- A. Seed shall be sown as specified in Section 3.05. Within 24 hours after covering of seed, excelsior mulch shall be uniformly applied at the rate of 2 tons per acre. The mulch may be applied hydraulically or by other acceptable methods. Should the mulch be placed in a dry condition, it shall be thoroughly wetted immediately after placing. Engineer may require light rolling of the mulch to form a tight mat.

3.08 SEED PROTECTION (WOOD CELLULOSE FIBER MULCH)

- A. After the lime has been applied and ground prepared as specified in Section 3.4, wood cellulose fiber mulch shall be applied at a rate of 1,500 pounds per acre in a mixture of seed and fertilizer. Hydraulic equipment shall be used for application of fertilizer, seed, and slurry of the prepared wood pulp. This equipment shall have a built-in agitation system with an operating capacity sufficient to agitate, suspend, and homogeneously mix a slurry of the specified amount of fiber, fertilizer, seed, and water. The slurry distribution lines shall be large enough to prevent stoppage. The discharge line shall be equipped with a set of hydraulic spray nozzles which will provide an even distribution of slurry on various areas to be seeded. The slurry tank shall have a minimum capacity of 1,000 gallons.

Seed, fertilizer, wood pulp mulch, and water shall all be combined into the slurry tank for distribution of all ingredients in one operation by hydraulic seeding method specified herein. Materials shall be combined in a manner recommended by the manufacturer. The slurry mixture shall be regulated so amounts and rates of application shall result in a uniform application of all materials at rates not less than amount specified. Using the color of wood pulp as a guide, equipment operator

shall spray prepared seedbed with a uniform visible coat. The slurry shall be applied in a sweeping motion, in an arched stream to fall like rain, allowing wood fibers to build upon each other until an even coat is achieved.

3.09 SPRIGGING

- A. Sprigs shall be placed at the date and rates as shown in section 2.06. The sprigging method shall be by broadcast sprigging, hydroplanting or row planter. Sprigging procedure shall ensure even coverage.
- B. Sprigs applied by broadcast over the site with a distributor or hydroseeder shall be planted at the rates listed in section 2.06. Cover broadcast sprigs with straw mulch immediately after broadcast and water in immediately (within 2 hours).
- C. Sprigs installed by row planter creating a narrow furrow that covers 50 to 80% of the sprig with soil may use less sprig material. Rate shall be as recommended by sprig supplier to provide a solid stand of turf within the time required in Section 2.06. Water in immediately (within 1 hour).

3.10 SODDING

- A. Sod shall be placed between March 1st and December 1st. However, if sod is to be placed during periods of temperatures over 90 degrees F., the Contractor shall take extra care for quick placement of sod with adequate, consistent watering necessary to ensure sod thrives as planted.
- B. Sod shall be placed within 24 hours of cutting.
- C. Place top elevation of sod 1/2 inch below adjoining paving or curbs.
- D. All areas to be sodded shall be brought to the proper line grade or cross section as was existing prior to construction. Sod shall be placed so, upon completion, edges of sodded areas will be smooth and will conform to the proposed finished grade. Sod shall be laid smooth, edge to edge, with staggered joints. Sod shall be immediately pressed firmly into contact with the sod bed by tamping or rolling, to eliminate any air pockets. A true and even surface shall be provided, to insure knitting without displacement of the sod or deformation of the sodded areas surfaces. Do not stretch or overlap sod pieces. Following compaction, screened soil of good quality shall be used to fill all cracks. Excess soil shall be worked into the grass with rakes or other suitable equipment. On slopes steeper than 3 to 1, sod shall be fastened in place with suitable wood or metal pins to hold the sod in place. Any damage by erosion or other causes occurring after completion of grading operations shall be repaired, before commencing with the sodding operations.
- E. Immediately before sodding, moisten topsoil with a fine spray to a minimum 1-inch depth. Sod shall not be laid on dry or powdery soil.
- F. Sod shall be moist when laid and placed on moist ground. The sod shall be carefully placed by hand, beginning at the toe of slopes and working upwards. The length of strips shall be at right angles to flow of surface water. All joints shall be tightly butted and end joints shall be staggered at least 12 inches. Sod shall

be immediately pressed firmly into the ground by tamping or rolling. Fill all joints between strips with fine screened soil. Sod on slopes shall be pegged with sod pegs to prevent movement.

- G. Within two hours after sod has been placed, thoroughly water to a minimum depth of 4-inches. After sod and soil have dried, roll sodded areas to ensure good bond between sod and soil and to remove depressions and irregularities. Roll sodded areas with a roller not exceeding 150 lbs. per foot of roller width.

PART 4 – MAINTENANCE, WARRANTY AND ACCEPTANCE

4.01 MAINTENANCE

- A. Maintain grassed surfaces until final acceptance.
- B. Maintenance shall consist of providing protection against traffic, watering to ensure uniform seed germination and to keep surface of soil damp, and repairing any areas damaged as a result of construction operations or erosion. Maintenance shall also include, but is not limited to, watering, weeding, cultivating, removal of dead material, lawn mowing, fertilizing, and other necessary operations.
- C. The Contractor shall maintain all proposed plantings until the date of substantial completion issued by the Owner.

4.02 WARRANTY

- A. All grassed areas shall be guaranteed by Contractor to be alive and healthy during the warranty period as issued by the Owner. A final walk through with the Owner shall be conducted at end of warranty period to determine if any areas require replanting. At end of warranty period, sod shall show evidence of rooting to underlying soil and shall have no competitive weed growth from either the sod or from between sod joints.
- B. Any grassed area which is dead or not showing satisfactory growth shall be replaced at Contractor's expense at the end of warranty period. All replacement shall be of original quality. Replacement required because of vandalism, excessive use, or other causes beyond the control of Contractor are not part of this contract.

4.03 ACCEPTANCE

- A. Before acceptance of seeding performed for the establishment of permanent vegetation, Contractor will be required to produce a satisfactory stand of perennial grass whose root system shall be developed sufficiently to survive dry periods and winter weather and be capable of reestablishment in spring.
- B. A minimum coverage of 90% density over 100% of the disturbed area is required for seeded areas before project acceptance. Sprig and sod areas shall have 95% coverage over 100% of the disturbed area prior project acceptance.

END OF SECTION