CES INC Engineers • Environmental Scientists • Surveyors

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TECHNICAL SPECIFICATIONS

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CES INC

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SECTION 01 10 00

SUMMARY OF WORK

PART 1 - GENERAL

1.1 REQUIREMENT INCLUDED

A. The work to be performed under this Contract shall consist of furnishing all tools, equipment, materials, supplies, and manufactured articles and for furnishing all transportation and services, including fuel, power, water, and essential communications, and for the performance of all labor, work, or other operations required for the fulfillment of the Contract in strict accordance with the specifications, drawings, and other Contract Documents as herein before defined, all of which are made a part hereof, and including such detail sketches as may be furnished by the Engineer from time to time during construction in explanation of said Contract Documents. The work shall be complete, and all work, materials, and services not expressly shown or called for in the Contract Documents which may be necessary for the complete and proper construction of the work in good faith shall be performed, furnished, and installed by the Contractor as though originally so specified or shown, at no increase in cost to the Owner.

1.2 RELATED SECTIONS

A. Section 01 56 00: Temporary Facilities and Controls.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The work shall consist of the construction of the sewer service and restoration of the site as shown in the Contract Documents.

1.4 CONTRACT METHOD

A. The work hereunder will be constructed under unit prices as indicated in the Bid Schedule.

B. The Contractor shall include the General Conditions and Supplementary General Conditions of the Contract as a part of all of its subcontract agreements.

1.5 WORK BY OTHERS

A. The Contractor's attention is directed to the fact that work may be conducted at the site by other Contractors during the performance of the work under this contract. The Contractor shall conduct its operations so as to cause a minimum of interference with the work of such other Contractors and shall cooperate fully with such Contractors to provide continued safe access to their respective portions of the site, as required to perform their respective contracts.

B. Interference with Work on Utilities: The Contractor shall cooperate fully with all utility forces of the Owner or forces of other public or private agencies engaged in the relocation, altering, or otherwise rearranging of any facilities which interfere with the progress of the work, and shall schedule the work so as to minimize interference with said relocation, altering, or other rearranging of facilities.

1.6 WORK SEQUENCE

A. The Contractor shall coordinate construction schedule and operations with Owner.

B. Contractor shall submit to Owner and Engineer a Work Plan outlining the Work Schedule, Traffic Control Plan, and Work Area Barricading Plan. The Work Plan shall be approved by the Owner and Engineer prior to construction.
   1. Failure of the Contractor to abide to the approved Work Plan shall result in suspension of work until corrections are made to follow the approved Work Plan.
   2. Revisions to the approved Work Plan shall be submitted to the Owner and Engineer for approval.

C. Contractor shall perform a pre-construction video of the entire project area prior to any construction activity. Contractor shall provide a copy of the video to the Owner and Engineer. Cost shall be incidental to the project.

1.7 CONTRACTOR USE OF PROJECT SITE

A. The Contractor's use of the project site shall be limited to its construction operations, including on-site storage of materials, on-site fabrication facilities, and field offices.

1.8 ACCESS TO SITE

A. Representative of the Owner and Owner Representatives shall have access to the work whenever it is in preparation or progress and the Contractor shall provide proper facilities for such access and inspection.

END OF SECTION

CES INC

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Quality assurance/control of installation.

B. References.

C. Field samples.

D. Testing laboratory services.

E. Manufacturer's field services and reports.

1.2 RELATED SECTIONS

A. Section 01 60 00 – Product Requirements.

B. Section 31 23 16 - Excavation.

C. Section 31 23 23 - Backfill.

1.3 QUALITY ASSURANCE/CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship to produce Work of specified quality.

B. Comply fully with Manufacturer's instructions, including each step, in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Engineer before proceeding.

D. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Perform work by persons qualified to produce workmanship of specified quality.

F. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

1.4 REFERENCES

A. Conform to reference standard by date of issue current on date of Contract Documents.

1.5 TESTING LABORATORY SERVICES

A. Contractor shall employ the services of a qualified firm to perform quality control testing in the field or laboratory on moisture-density relationships (Proctors) and relative density tests on embankments, fill and backfill materials, in-place field density tests on embankments and fills, and other materials and equipment during and after their incorporation in the Work. Field sampling and testing shall be performed by the testing firm with minimum interference with construction operations. Owner shall determine the time and location of field sampling and testing as necessary to determine that materials and equipment conform to the Contract Documents.

Contractor shall furnish all sample materials and cooperate in the sampling and field-testing activities. Contractor will furnish personnel, equipment, and facilities to perform sampling and field testing activities and to deliver samples and test specimens to the testing laboratory.

If tests indicate Work that does not meet specified requirements, remove work, replace, and retest at no cost to Owner.

Contractor shall be responsible for all testing laboratory services in connection with pipe and appurtenances testing, topsoil analysis testing, and other necessary testing not included in paragraph 1.5A above.

END OF SECTION

CES INC

SECTION 01 56 00

TEMPORARY FACILITIES AND CONTROL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Water Control.

B. Dust Control.

C. Erosion and Sediment Control.

D. Pollution Control.

1.2 RELATED SECTIONS

A. Section 01 10 00 - Summary of Work.

B. Section 31 23 16 - Excavation.

1.3 WATER CONTROL

A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

1.4 DUST CONTROL

A. Execute Work by methods to minimize raising dust from construction operations.

B. Provide positive means to prevent air-borne dust from dispersing into atmosphere.

1.5 EROSION AND SEDIMENT CONTROL

A. Plan and execute construction by methods to control surface drainage from cuts and fills. Prevent erosion and sedimentation.

B. Minimize amount of bare soil exposed at one time.

C. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.

D. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

1.6 POLLUTION CONTROL

A. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.

B. Contractor shall provide dust control and cleaning as needed and per Engineer's recommendation due to construction activity.

END OF SECTION

CES INC

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Products.

B. Transportation and handling.

C. Storage and protection.

D. Product options.

E. Substitutions.

1.2 RELATED SECTIONS

A. Section 01 40 00 - Quality Requirements.

1.3 PRODUCTS

A. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work. Does not include machinery and equipment used for preparation, fabrication, conveying, and erection of the Work. Products may also include existing materials or components required for reuse.

B. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.

1.4 TRANSPORTATION AND HANDLING

A. Transport and handle products in accordance with manufacturer's instructions.

B. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.

C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.5 STORAGE AND PROTECTION

A. Store and protect products in accordance with manufacturer's instructions, with seals and labels intact and legible.

B. For exterior storage of fabricated products, place on sloped supports, above ground.

C. Provide off-site storage and protection when site does not permit on-site storage or protection.

D. Store loose granular materials on solid flat surfaces in a well-drained area. Avoid mixing with foreign matter.

E. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

F. Arrange storage of products to permit access for inspection. Periodically inspect to assure products are undamaged and are maintained under specified conditions.

1.6 PRODUCT OPTIONS

A. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions.

B. The Engineer will consider requests for substitutions.

END OF SECTION

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SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cast-in-place concrete curb and thrust blocks.

1.2 RELATED SECTIONS

A. Section 03 10 00 - Concrete Formwork: Formwork and accessories.

B. Section 03 20 00 - Concrete Reinforcement.

1.3 REFERENCES

A. ACI 301 - Specifications for Structural Concrete for Buildings.

B. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

C. ACI 305R - Hot Weather Concreting.

D. ACI 306R - Cold Weather Concreting.

E. ACI 308 - Standard Practice for Curing Concrete.

F. ACI 318 - Building Code Requirements for Reinforced Concrete.

G. ASTM C33 - Concrete Aggregates.

H. ASTM C94 - Ready-Mixed Concrete.

I. ASTM C150 - Portland Cement.

J. ASTM C260 - Air Entraining Admixtures for Concrete.

K. ASTM D1752 - Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

1.4 SUBMITTALS FOR REVIEW

A. Product Data: Provide data on concrete mix, joint devices, attachment accessories, and admixtures.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301.

B. Acquire cement and aggregate from same source for all work.

C. Conform to ACI 305R when concreting during hot weather.

D. Conform to ACI 306R when concreting during cold weather.

1.6 COORDINATION

A. Coordinate work with other affected trades.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

A. Cement: ASTM C150, Type II - Moderate, Portland type.

B. Fine and Coarse Aggregates: ASTM C33.

C. Water: Clean and not detrimental to concrete.

2.2 ADMIXTURES

A. Air Entrainment: ASTM C260.

2.3 ACCESSORIES

A. Non-Shrink Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 5,000 psi in 28 days.

2.4 JOINT DEVICES AND FILLER MATERIALS

A. Joint Filler: Polyurthane Sealant Grade P Class 25.

2.5 CONCRETE MIX

A. Mix and deliver concrete in accordance with ASTM C94.

B. Provide concrete in accordance with the Master Limits Table below:

Master Limits Table

	A	Y
Compressive Strength (psi at 28 day)	4000	3000
Aggregate Size (maximum in inches)	0.75	0.75
Minimum Cement Content (lbs/CY)	611	635
Water/Cement Ratio (max. by wt.)	0.42	0.49
Slump - Plus or minus 1 inch	3	3
Air Entrained (percent)	4 to 6	4 to 6

C. Use accelerating admixtures in cold weather only when approved by Engineer. Use of admixtures will not relax cold weather placement requirements.

D. Use calcium chloride only when approved by Engineer.

E. Use set retarding admixtures during hot weather only when approved by Engineer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify site conditions.

B. Verify requirements for concrete cover over reinforcement.

C. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.

3.2 PREPARATION

A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.

B. Coordinate the placement of joint devices with erection of concrete formwork and placement of form accessories.

3.3 PLACING CONCRETE

A. Place concrete in accordance with ACI 301.

B. Notify Owner minimum 24 hours prior to commencement of operations.

C. Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints, are not disturbed during concrete placement.

D. Install joint devices in accordance with manufacturer's instructions.

E. Apply sealants in joint devices.

F. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

G. Place concrete continuously between predetermined expansion, control, and construction joints.

H. Do not interrupt successive placement; do not permit cold joints to occur.

3.5 CONCRETE FINISHING

A. Concrete surfaces to be left exposed with smooth rubbed finish.

B. Sidewalk concrete surfaces to be left exposed with a broom finish.

3.6 CURING AND PROTECTION

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

C. Protect concrete structures from frost penetration and action until building is permanently enclosed with a functioning heating system.

3.7 FIELD QUALITY CONTROL

A. Provide free access to Work and cooperate with testing firm.

B. Three concrete test cylinders will be taken for every 50 cubic yards or less of each class of concrete placed.

C. One additional test cylinder will be taken during cold weather concreting, cured on job site under same conditions as concrete it represents.

D. One slump test will be taken for each set of test cylinders taken.

3.8 PATCHING

A. Allow Engineer to inspect concrete surfaces immediately upon removal of forms.

B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Engineer upon discovery.

C. Patch imperfections in accordance with ACI 301.

3.9 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

B. Repair or replacement of defective concrete will be determined by the Engineer.

C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Engineer for each individual area.

3.10 SCHEDULE

A. Sidewalk: Type A.

END OF SECTION

CES INC

SECTION 31 10 00

SITE CLEARING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Remove surface debris.

B. Remove portion of sidewalk marked for removal

C. Clear site of plant life and grass.

D. Remove trees and shrubs.

E. Remove root system of trees and shrubs.

F. Topsoil Excavation.

1.2 RELATED SECTIONS

A. Section 31 23 16 – Excavation

B. Section 01 56 00 – Temporary Facilities & Control

1.3 REGULATORY REQUIREMENTS

A. Conform to applicable code for disposal of debris.

B. Contractor is required to contact Sunshine 811 prior to construction.

C. Coordinate clearing work with local utility companies.

PART 2 - EXECUTION

2.1 PREPARATION

A. Verify that existing plant life designated to remain is tagged or identified.

B. Install silt fencing in accordance with Section 01 56 00 before starting clearing.

C. Coordinate clearing work with Owner.

2.2 PROTECTION

A. Locate, identify, and protect utilities that are to remain, from damage.

B. Protect trees, plant growth, and features designated to remain as final landscaping.

C. Protect benchmarks and existing structures from damage or displacement.

2.3 CLEARING

A. Remove concrete where applicable.

B. Remove trees and shrubs within marked areas. Remove stumps, main root ball, root system and surface rock to depth limitation on plans.

C. Clear undergrowth and deadwood using proper methodology to minimize the mixing of topsoil.

D. Clear areas required for access to site and execution of work.

2.4 REMOVAL

A. Any debris, rock, and extracted plant life must be removed off site and disposed of at an approved location.

B. Remove the existing site features as indicated on the Contract Drawings and disposed of at an approved location. The Owner shall have first right and refusal of the equipment and materials associated with the site features.
   1. Contractor to fill all abandoned pipes with flowable fill. Contractor to ensure that entire run of abandoned pipe is filled with flowable fill.

END OF SECTION

SECTION 31 22 13

ROUGH GRADING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Completion of rough grading.

B. Removal of topsoil and subsoil. Stockpile for later reuse.

C. Grading and rough contouring the site.

1.2 RELATED SECTIONS

C. Section 31 10 00 – Site Clearing.

D. Section 31 23 16 – Excavation.

F. Section 31 23 23 – Backfill.

1.3 REFERENCES

A. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12-inch (304.8 mm) Drop.

B. ANSI/ASTM D1556 - Test Method for Density of Soil in Place by the Sand-cone Method.

C. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18-inch (457 mm) Drop.

1.4 SITE CONDITIONS

A. It is the intent of this item for the Contractor to perform whatever rough grading may be required to complete installation of sewer service and sidewalk replacement.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Topsoil: Excavated material, graded, free of roots, rocks larger than 1-inch subsoil, debris, and large weeds.

B. Subsoil: Excavated material, graded, free of lumps larger than six inches, rocks larger than three inches and debris.

PART 3 - EXCAVATION

3.1 EXAMINATION

A. Verify site conditions under provisions of Section 31 10 00.

B. Verify that survey benchmark and intended elevations for the work are as indicated.

3.2 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Identify known underground, above ground, and aerial utilities. Stake and flag locations.

C. Notify utility company to remove and relocate utilities if required.

D. Protect above or below grade utilities which are to remain.

E. Upon discovery of unknown utility or concealed conditions, discontinue affected Work. Notify Engineer and Owner.

F. Protect plant life and other features remaining as a portion of final landscaping.

G. Protect benchmarks, existing structures, fences, sidewalks, paving, and curbs from excavation equipment and vehicular traffic.

3.3 TOPSOIL EXCAVATION

A. Excavate topsoil from areas to be further excavated.

B. Stockpile in area designated on site. Cover to protect from erosion. Remove excess topsoil not being reused, from site.

C. Do not excavate wet topsoil.

3.4 SUBSOIL EXCAVATION

A. Excavate subsoil from areas to be further excavated, landscaped, or re-graded.

B. Stockpile in area designated on site. Remove excess subsoil not being reused, from site.

C. Do not excavate wet subsoil, dewater prior to excavation.

D. Stockpile subsoil to depth not exceeding eight feet. Cover to protect from erosion.

E. When excavation through roots is necessary, perform work by hand and cut roots with sharp axe.

3.5 FILLING

A. Granular Fill: Place and compact materials in continuous layers not exceeding 8 inches compacted depth, compacted to 95 percent.

B. Subsoil Fill: Place and compact material in continuous layers not exceeding 8 inches compacted depth, compacted to 95 percent.

C. Maintain optimum moisture content of fill materials to attain required compaction density.

D. Slope grade away from building minimum six inches in 10 feet unless noted otherwise.

E. Make grade changes gradual. Blend slope into level areas.

F. Remove surplus fill materials from site.

3.6 TOLERANCES

A. Top Surface of Subgrade: Plus or minus one-inch.

3.7 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01 40 00.

B. Compaction testing will be performed in accordance with ANSI/ASTM D1557, ANSI/ASTM D2922, and with Section 01 40 00.

C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

D. Frequency of Tests: One test per 1,000 s.f.

END OF SECTION

CES INC

SECTION 31 23 16

EXCAVATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Excavation for site structures.

1.2 RELATED SECTIONS

A. Section 31 10 00 – Site Clearing.

B. Section 31 23 17 - Trenching.

C. Section 31 23 23 - Backfill.

1.3 FIELD MEASUREMENTS

A. Verify that survey benchmark and intended elevations for the Work are as indicated.

PART 2 - EXECUTION

2.1 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Identify known underground, above ground and aerial utilities. Stake and flag locations.

C. Erect sheeting, shoring, and bracing as necessary for protection of persons, improvements, and excavations and as indicated on the Drawings.

D. Provide dewatering and drainage as required to accomplish work of this section.

E. Protect new construction, existing structures, existing utilities, plants, trees, etc. at all times. Report any damages immediately to Engineer and proper authorities.

F. Use extreme caution when excavating near underground utilities. Employ manual excavation where necessary.

G. Inform appropriate utility or agency of all actions in vicinity of underground pipes, mains, conducts, wires, etc. Coordinate all work with appropriate utility or agency and comply with all requirements.

2.2 EXCAVATION

A. Underpin adjacent structures which may be damaged by excavation work, including utilities and pipe chases.

B. Excavate existing material as necessary and as delineated on the Contract Drawings. Excavated material may be used as backfill as specified in Section 31 23 23, when approved by the Engineer.

C. Machine slope banks to angle of repose or less, until shored.

D. Excavate all materials regardless of nature of elevations and dimensions indicated plus sufficient space for forming, shoring, draining, inspection, etc. Excavate using open cut method unless otherwise indicated or permitted.

E. Grade top perimeter of excavation to prevent surface water from draining into excavation.

F. Hand trim excavation. Remove loose matter.

G. Remove lumped subsoil, boulders, and rock up to two cubic yards measured by volume.

H. Allow Engineer to inspect bottom of excavation for suitability of base material.

I. Remove unsuitable base material to a depth of at least six inches below any pipe or structure or to a depth directed by the Engineer and replace with compacted screened gravel or crushed stone or provide proper base as otherwise directed by Engineer. Place no footing, wall, structure, pipe, etc. on unsuitable material.

J. Place no structure, pipe, etc. partially on earth and partially on rock. Remove rock and replace with compacted screened gravel or crushed stone.

K. Notify Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

L. Correct unauthorized excavation at no extra cost to Owner.

M. Correct areas over-excavated by error in accordance with Section 31 23 23.

N. Stockpile excavated material in area designated on site and remove excess material not being reused, from site.

2.3 FIELD QUALITY CONTROL

A. Field inspection will be performed under provisions of Section 01 40 00.

B. Provide for visual inspection of bearing surfaces.

2.4 PROTECTION

A. Protect excavations by methods required to prevent cave-in or loose soil from falling into excavation.

END OF SECTION

CES INC

SECTION 31 23 17

TRENCHING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Excavation of trenches for utilities.

B. Bedding and backfilling of utilities.

C. Compaction of bedding and backfill material over utilities to subgrade elevations.

1.2 RELATED SECTIONS

A. Section 31 23 16 – Excavation.

C. Section 31 37 00 - Riprap.

D. Section 32 12 16- Asphaltic Paving.

E. Section 33 41 00 – Storm Sewage System.

1.3 REFERENCES

A. ANSI/ASTM C136 – Method for Sieve Analysis of Fine and Coarse Aggregates.

B. ANSI/ASTM D1557 – Modified Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 10 lb Rammer and 18-inch Drop.

1.4 FIELD MEASUREMENTS

A. Verify that survey benchmark and intended elevations for the Work are as shown on drawings.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

A. Types as specified in Section 31 23 23.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify fill materials to be reused, are acceptable and obtain Engineer's approval.

3.2 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Maintain and protect existing utilities remaining, which pass through work area.

C. Protect plant life, lawns, rock outcropping and other features remaining as a portion of final landscaping.

D. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavation equipment and vehicular traffic.

E. Protect above and below grade utilities which are to remain.

F. Cut out soft areas of subgrade not capable of in situ compaction. Backfill with approved granular material and compact to density equal to or greater than requirements for subsequent backfill material.

G. Cut pavement using masonry saw, pavement breaker, or other appropriate device to provide a uniform edge and to minimize damage to remaining pavement. Do not use removed pavement as fill.

3.3 EXCAVATION

A. Excavate subsoil required for water service installation, culverts, sanitary sewers, storm sewers, underground conduits, and precast light bases.

B. Cut trenches sufficiently wide to enable installation of utilities and allow inspection.

C. Excavation shall not interfere with normal 45 degree bearing splay of foundations.

D. Hand trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.

E. Remove lumped subsoil, boulders, and rock up to two cubic yards, measured by volume.

F. Correct unauthorized excavation at no cost to Owner.

G. Correct areas over-excavated by error in accordance with Section 31 23 23.

H. Stockpile excavated material in area designated on site and provide proper erosion control measures. Excess material shall be removed off site and disposed of properly.

3.4 BEDDING

A. Support pipe and conduit during placement of crushed stone or specified bedding material.

B. Do not compact crushed stone over any flexible plastic pipe.

C. Bedding material thickness shall be in accordance with the Contract Drawings.

3.5 BACKFILLING

A. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, or spongy subgrade surfaces.

B. Granular Fill: Place and compact materials in continuous layers not exceeding six inches compacted depth.

C. Soil Fill: Place and compact material in continuous layers not exceeding eight inches compacted depth.

D. Employ a placement method that does not disturb or damage pipe in trench.

E. Maintain optimum moisture content of fill materials to attain required compaction density.

F. Surplus fill materials shall be removed off site.

G. Fill material stockpile areas shall be compiled neatly and provided proper erosion control protection.

3.6 TOLERANCES

A. Top Surface of Backfilling: Under Paved Areas plus or minus one half inch from required elevations.

B. Top Surface of General Backfilling: Plus or minus one inch from required elevations.

3.7 FIELD QUALITY CONTROL

A. Field testing will be performed under provisions of Section 01 40 00.

B. Tests and analysis of fill material will be performed in accordance with ANSI/ASTM D1557 and Section 01 40 00.

C. Compaction testing will be performed in accordance with ANSI/ASTM D6938 and with Section 01 40 00.

D. If tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest at no cost to Owner.

3.8 PROTECTION OF FINISHED WORK

A. Protect finished Work under provisions of Section 01 56 00.

END OF SECTION

CES INC

SECTION 31 23 23

BACKFILL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Site filling and backfilling.

B. Fill, aggregate subbase, and aggregate base under paving.

C. Consolidation and compaction.

D. Fill for over-excavation.

1.2 RELATED SECTION

A. Section 31 23 16 - Excavation.

B. Section 31 23 17 - Trenching.

C. Section 31 37 00 - Riprap.

D. Section 32 12 16 - Asphaltic Paving.

1.3 REFERENCES

A. ANSI/ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.

B. ANSI/ASTM D1557 – Modified Test Method for Moisture Density Relations of Soils and Soil Aggregate Mixtures, Using 10 lb Rammer and 18-inch Drop.

D. ASTM D6938 – Standard Test Method for In-Place Density and water content of soil and soil aggregate by Nuclear Methods (Shallow Depth).

E. ASTM D2487 - Classification of Soils for Engineering Purposes.

F. ASTM 4318 - Test Method For Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

G. ASTM D1140 - Test Method For Amount of Material in Soils Finer than the No. 200 (75 -

PART 2 - PRODUCTS

2.1 SUITABLE FILL AND BACKFILL MATERIAL REQUIREMENT

A. General: Fill, backfill, and embankment materials shall be suitable selected or processed clean, fine earth, rock or sand, free from grass, roots, brush, or other vegetation.

B. Fill and backfill to be placed within 6 inches of any structure or pipe shall be free of rocks or unbroken masses of earth materials having a maximum dimension no larger than 3 inches for structures, and 1 inch for DI, PVC and HDPE pipe.

C. Suitable Materials: Soils not classified as unsuitable as defined in paragraph entitled, "Unsuitable Material" herein, are defined as suitable material and may be used in fills, backfilling, and embankment construction subject to approval by Engineer, some of the material listed as unsuitable may be used when thoroughly mixed with suitable material to form a stable composite.

D. Suitable materials may be obtained from on-site excavations, may be processed on-site materials, or may be imported. If imported materials are required to meet the requirements of the section or to meet the quantity requirements of the project, the Contractor shall provide the imported materials at no additional expense to the Owner, unless a unit price item is included for imported materials in the bidding schedule.

E. The following types of suitable materials are designated and defined as follows:

1. COMMON BORROW

Common borrow shall consist of earth, suitable for embankment construction. It shall be free from perishable rubbish, peat, and other unsuitable material.

The moisture content shall be sufficient to provide the required compaction and stable embankment. In no case shall the moisture content exceed 4 percent above optimum.

The optimum moisture content shall be determined in accordance with ASTM D1557.

2. CRUSHED STONE/BEDDING MATERIAL

Crushed stone shall be durable crushed rock consisting of the angular fragments obtained by breaking and crushing solid or shattered natural rock and reasonably free from thin, flat, elongated, or other objectionable pieces. The crushed stone shall be reasonably free from sand, clay, loam, chemical decay, or deleterious materials and not more than one percent of material passing a No. 200 sieve will be allowed to adhere to the crushed stone. The crushed stone shall be uniformly blended according to the grading requirements listed in the following table:

3/4 inch crushed stone:

Sieve Size	Weight Passing (%)
1"	100
3/4"	95-100
1/2"	35-70
3/8"	0-25

1½ inch crushed stone:

Sieve Size	Weight Passing (%)
2"	100
1"	0-60
3/4"	0-30
1/2"	0-15
3/8"	0-25

3. SAND

Sand shall be well graded coarse sand without excessive fines and free from loam, clay, and organic matter. Beach sand shall not be used. The grading requirements are as follows:

Sieve Size	Weight Passing (%)
3/8"	100
No. 4	95-100
No. 16	50- 85
No. 50	0-30
No. 100	2-10

4. AGGREGATE SUBBASE

Aggregate subbase shall be sand or gravel consisting of hard durable particles which are free from vegetable matter, lumps, or balls of clay, and other deleterious substances. The gradation of the portion which will pass a 3-inch sieve shall meet the grading requirements of the following table:

Sieve Size	Weight Passing (%)
1/4"	25-70
No. 40	0-30
No. 200	0-7

Granular subbase and gravel subbase shall not contain particles of rock which will not pass the 6-inch square mesh sieve.

Gradation tests shall conform to ASTM C136 except that the material may be separated on the ½ inch sieve.

5. AGGREGATE BASE

Aggregate Base shall be screened or crushed gravel consisting of hard durable particles which are free from organic matter, lumps or balls of clay, and other deleterious substances. The gradation shall meet the grading requirements of the following table:

Sieve Size	Weight Passing (%)
1/2"	45-70
1/4"	30-55
No. 40	0-20
No. 200	0-5

Screened or crushed gravel base shall not contain particles or rock which will not pass the 2 inch square mesh sieve.

Gradation tests shall conform to ASTM C136 except that the material may be separated on the ½ inch sieve.

6. STRUCTURAL FILL AND BACKFILL

Structural fill shall be a material free from organic matter, and other deleterious substances. Maximum particle size should not exceed two-thirds of the proposed loose lift thickness. All fill will be compacted to at least 95% of its a maximum dry density as determined by ASTM D-6938.

Fill placed adjacent to foundations as backfill will be a clean granular material meeting the gradation requirements of the following table.

Sieve Size	Weight Passing (%)
4"	100
3"	90-100
¼"	25-90
#40	0-30
#200	0-5

7. REFILL MATERIAL

Refill material for replacement of unsuitable material or rock excavation below grade shall be aggregate subbase material or crushed stone of 3/4 inch maximum size, free from silt, loam, and clay.

8. BEDDING MATERIAL

Where any of the above material is to be used for bedding materials, it shall further meet the following additional criteria. Bedding material shall be so graded that 100% will pass a one (1) inch screen and not more than 10% will pass a 200-mesh sieve. Gradation test results of the bedding material shall be submitted to the Engineer for approval. In the event abnormally unstable or wet conditions are encountered, bedding material shall be crushed stone, if directed by the Engineer.

2.2 UNSUITABLE MATERIAL

A. Unsuitable soils for fill and backfill material shall include soils which, when classified under the standard method for "Classification of Soils for Engineering Purposes"(ASTM D2487), fall in the classifications of Pt, OH, CH, MH, or OL.

B. In addition, any soil containing organic matter, having a plastic limit of less than 8 percent when tested in accordance with the requirements of ASTM D4318 and containing more than 25 percent of material, by weight, passing the No. 200 sieve when analyzed according to the requirements of ANSI/ASTM D1140, or any soil which cannot be compacted sufficiently to achieve the percentage of maximum density specified for the intended use, shall be classed as unsuitable material.

2.3 SUBMITTALS

A. Contractor shall submit testing in accordance with Section 01 40 00.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify fill materials to be reused are acceptable.

3.2 PREPARATION

A. Scarify and recompact subgrade to density required for subsequent backfill materials.

B. Cut out soft areas of subgrade not capable of insitu compaction. Backfill with an approved granular material and compact to a density equal to or greater than requirements for subsequent backfill material.

C. Prior to placement of aggregate subbase course material at paved areas, compact subsoil to 95 percent of its maximum dry density as analyzed in accordance with ANSI/ASTM D1557 and field tested in accordance with ASTM D6938.

3.3 BACKFILLING

A. Use suitable materials from excavations which conform to the requirements herein or are approved by the Engineer for backfill up to rough grade lines except where these specifications have more stringent or special requirements for certain parts of the contract work. Supply extra fill if there is not enough fill to complete the project. Use no material from any excavation as backfill unless approved by the Engineer.

B. Material within two feet of finished grade in any areas to be paved or within five feet horizontally of any structure shall contain no stone having any dimension exceeding six inches. Excess and unsuitable excavated materials shall be stock piled onsite at the Owner's discretion. In the event sufficient suitable excavated material is not available for backfill, supply a granular backfill.

C. Place materials in layers of thicknesses specified herein but in no case greater than 12 inches before compaction. Wet backfill when necessary, uniformly to obtain required density. Compact each layer with vibratory compactors before placing next layer.

D. In cross-country runs, trenches shall be backfilled and mounded six inches above surrounding grade in addition to the normal compaction procedure.

E. In backfilling around structures, place material in 8 inch layers and then compact. Allow no heavy machinery within 5 feet of structure during placement. Place no material until structure can withstand the load. Place temporary backfill where required and remove when no longer required. Bring backfill up evenly on all sides of the structure.

F. Systematically backfill to allow maximum time for natural settlement. Do not backfill overporous, wet, or spongy subgrade surfaces.

G. Maintain moisture content within 2 percent, plus or minus, of optimum moisture content of backfill materials to attain required compaction density.

3.4 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01 40 00.

B. Tests and analysis of fill material will be performed in accordance with ANSI/ASTM D1557 and with Section 01 40 00.

C. Compaction testing will be performed in accordance with ANSI/ASTM D6938 and with Section 01 40 00.

D. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

E. Frequency of Tests: Compaction Tests -
   1. Trench - 1 test every 300 feet varying lifts.

F. Proof roll compacted fill surfaces under paving.

G. Minimum densities following compaction shall be as follows:

Fill and Backfill Location	Modified Proctor Density %
Top two feet under pavement	95
Under or within five feet of structures	95
Fill For Erosion Repair Areas	92
Under pavements below top two feet	92
Trenches through unpaved areas	92
In embankment (including temporary)	92
Pipe bedding and trenching	92

H. Compaction shall be accomplished by appropriate methods, i.e., vibratory compaction

of granular materials, sheepsfoot compaction of cohesive materials, etc. In no case shall trench compaction be deemed adequate with the use of a non-compactive device such as a bulldozer.

The Engineer may withhold 5 percent of the monthly requisition if in his opinion proper compaction was not met. Improperly compacted materials shall be removed, replaced, or recompacted.

3.5 PROTECTION OF FINISHED WORK

A. Protect finished Work under provisions of Section 01 56 00.

B. Recompact fills subjected to vehicular traffic.

END OF SECTION

CES INC

SECTION 33 31 00

SANITARY SEWAGE SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Sanitary Gravity Sewer and Forcemain Piping.

B. Service Lateral and connection to existing sewer system.

C. Fittings.

D. Testing.

1.2 RELATED SECTIONS

A. Section 01 60 00 - Product Requirements

B. Section 31 23 16 - Excavating

C. Section 31 23 17 - Trenching

D. Section 31 23 23 - Backfilling

1.3 REFERENCES

A. ANSI/ASTM D3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

B. ANSI A3212 - Joints for Drain and Sewer Pipes using Flexible Elastomeric Seals.

C. ASTM D1784-90: Specification for rigid poly vinyl chloride (PVC) compounds and chlorinated poly vinyl chloride (CPVC) compounds.

D. ASTM 1869: Specification for rubber rings for asbestos-cement pipe.

E. ASTM 3035, Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter

F. ASTM 3350, Standard Specification for Polyethylene Plastic Pipe and Fitting Materials

1.4 PROJECT RECORD DOCUMENTS

A. Submit the following:
   1. Documents for requirements of Contract closeout, including but not limited to, warranties, testing, adjusting, spare parts, etc.
   2. Accurately record location of pipe runs, connections, manholes, and invert elevations.
   3. Field measurements for locating ends of unconnected service laterals.
   4. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver products on manufacturer's original skids, or in original unopened protective packaging.

B. Store materials to prevent physical damage.

C. Protect material during transportation and installation to avoid physical damage.

PART 2 - PRODUCT

2.1 MANUFACTURERS

A. PVC Pipe - JM Eagle, Inc., Extrusion Technologies, Inc., or approved equal.

B. Couplings - Fernco, Inc., or approved equal.

C. Substitutions: In accordance with Section 01 60 00.

2.2 GRAVITY SEWER PIPE MATERIALS

A. Polyvinyl Chloride (PVC) Non-pressure Sewer Pipe, conforming to ASTM Specification D3034.
   1. Class: SDR 26
   2. Joints: Flexible Elastomeric Seals conforming to ASTM Specifications D3212.
      a. All joints to be an integral part of pipe bell.

B. Polyvinyl Chloride Resin Compound: Conforming to ASTM 1784.

C. Rubber gaskets for use with PVC pipe; ASTM D1869, all joints to be an integral part of pipe bell.

D. Elastomeric polyvinyl chloride fittings and reducers with stainless steel straps; meeting the requirements of ASTM C443, C425, C564, and D1869.

2.3 PIPE ACCESSORIES

A. Fittings: Same material as pipe, molded or formed to suit pipe size and end design, in wyes, bends, elbows, cleanouts, reducers, traps, and other configurations required.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that trench cut is ready to receive work, and excavations, locations, dimensions, and elevations are as indicated on Drawings.

B. Excavate test pits as necessary to verify locations and grades of existing utilities.

C. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

A. Hand trim excavations to required elevations. Correct over-excavation with ¾-inch crushed stone.

B. Remove large stones or other hard matter which could damage pipes or impede consistent bedding, backfilling or compaction.

3.3 GRAVITY/FORCEMAIN PIPE INSTALLATION

A. Install pipes, fittings and accessories according to manufacturer's instructions.

B. Place pipe on minimum 6-inch deep bedding. Bedding for PVC gravity pipe shall be ¾-inch crushed stone and bedding for HDPE force main shall be sand.

C. Lay pipe to alignment, slope gradient and elevations noted on Drawings.

D. Joints and joint material conforming to manufacturer's recommendation.

E. Lay pipe without break, upgrade from structure to structure with bell end upstream.

F. Install bedding at bottom sides and over top of pipe, at depths shown on Drawings.

G. Manually "chink" bedding around pipe haunches for lateral support.
   1. Do not mechanically compact crushed stone over flexible pipe.

H. Install and bed pipe up to spring line; do not cover pipe without the presence of the Owner.
   1. Work backfilled without presence of Owner shall be uncovered at Contractor's expense.

I. Place bedding material over pipe as indicated on drawings.

J. Backfill and secure each pipe length prior to installing next length.

K. Continue backfill placement to finish grade level as per Section 31 23 23.
   1. Place material in maximum 12-inch lifts, compact per Section 31 23 23.
   2. Increase compaction of each successive lift per Section 31 23 23.
   3. Do not displace or damage pipe during compaction.

L. Protect pipes against impact shocks and free falls.
   1. Remove and replace damaged pipe.
   2. Place and tamper sufficient bedding material over and around pipe to prevent damage and movement.

M. Install a water tight plug in open pipe ends when pipe laying not in progress.

N. Do not use pipe as trench drain.

3.4 FIELD QUALITY CONTROL

A. Examine pipes for defects, weak structural components, and deviations allowable tolerances.

B. Remove rejected materials from job site.

C. Obtain Owner certification and installation conformance to specifications prior to backfilling.

D. Install pipe to lines and grades shown on Contract Drawings.

E. Allowable Tolerances.
   1. Pipe elevation: plus or minus 0.02 feet/100 feet.
   2. Horizontal layout: plus or minus 0.03 feet/100 feet.

3.5 GRAVITY PIPE LEAKAGE TESTING

A. General:
   1. Test all lines after backfilling.
   2. Lines to meet infiltration limit of 100 gal/day/inch/mile.
      a. Limit inferred by air exfiltration test.

B. Low Pressure Air Test:
   1. Perform test according to stated procedures in presence of Engineer.
   2. Equipment used, a minimum:
      a. Pneumatic plugs with sealing length greater than or equal to pipe diameter.
      b. Plugs to resist test pressures requiring no external bracing
      c. Air used passing through single control panel.
      d. Use three (3) individual hoses for following connections:
         1. From control panel to pneumatic plugs for inflation.

2. From control panel to sealed line for introducing pressure air.
3. From sealed line to control panel for continually monitoring air pressure rise in sealed line.

3. Seal test plugs prior to actual test as follows:
   a. Seal both ends of a length of pipe laid on ground.
   b. Introduce air to plugs to 30 psig.
   c. Pressurize pipe to 5 psig.
   d. Plugs must hold without movement to pass.
4. After backfilling manhole to manhole segment:
   a. Clean pipe segment.
   b. Cap or suitably plug service connections.
   c. Place plugs in line at each manhole and inflate to 30 psig.
   d. Introduce air to sealed pipe to pressure of greater than or equal to 4 psig above average groundwater backpressure on line.
   e. Allow 2 minutes for air pressure stabilization.
   f. Maintain minimum of 3.5 psig after stabilization.
   g. Disconnect air supply from control panel.
   h. A test is acceptable if 0.5 psig pressure loss is greater than time shown in following table:

Pipe Size (Inches)	Time
4	2 min. 32 sec.
6	3 min. 50 sec.
8	5 min. 6 sec.
10	6 min. 22 sec.
12	7 min. 39 sec.

5. Areas of Known Groundwater:
   a. Install 1/2 inch diameter capped pipe nipple 10-inches long, through manhole wall above an inlet line.
   b. Prior to performing air test determine groundwater level as follows:
      1. Remove nipple cap.
      2. Blow air through nipple to clear.
      3. Connect clear plastic tube to nipple.
      4. Hold hose vertically and measure height of water.
      5. Divide height by 2.3 to obtain groundwater backpressure in psig.
6. If pipe segment fails air test:
   a. Perform necessary work to meet these requirements.
7. Provide as necessary, proper plugs, weirs and necessary equipment to perform tests.
8. Testing of pipe sections to include service connection portions installed under this Contract.
9. Provide, as necessary, equipment to bypass flow around test segments.
   a. Maintain service to services temporarily disconnected, capped or plugged for test.
10. Test each day's work.
    a. Pipe laying may be stopped by Engineer if testing procedures or results are unacceptable.

3.6 GRAVITY PIPE LIGHT TEST

A. Test all lines immediately after backfilling and compaction.

B. Light test manhole to manhole pipe sections.
   1. True circle of light visible from manhole to manhole for acceptance.

C. Remove and/or repair any pipe displacements discovered.

3.7 GRAVITY PIPE DEFLECTION TESTING

A. Test all lines not less than 30 days after backfilling and compaction.

B. Lines to be clean and free of foreign materials prior to testing.

C. Perform test in presence of Engineer.

D. Pull mandrel through pipes installed.

E. Maximum Deflection Allowable: Less than 7.5 percent of internal pipe diameter.

F. Remove and replace pipe sections failing test.

END OF SECTION