ITEM NO. 804
EXCAVATION, TRENCHING AND BACKFILL

804.1 DESCRIPTION: This section shall govern the excavation, trenching, and backfilling for water, sanitary sewer, and recycled water construction, unless otherwise noted in the contract documents. The work shall include all necessary drainage, dewatering, pumping, bailing, sheeting, shoring and incidental construction. All existing utilities shall be protected from damage during the excavation and backfilling of trenches and, if damaged, shall be replaced by the Contractor at his expense. Unless otherwise shown in the contract documents, all excavation shall be unclassified and shall include all materials encountered regardless of their nature or the manner in which they are removed, to include but not limited to rock, stone, sand, organic material, or whatever material is encountered. The Contractor shall at all times conform to the latest applicable provision of subpart “P” entitled “Excavation, Trenching, and Shoring of OSHA Safety and Health Regulations for Construction”, or most applicable approved equal provision. An excavation plan submittal signed and sealed by a Texas licensed professional engineer shall be submitted for review and acceptance by the Owner or Engineer, if applicable, one week prior to start of actual construction activities where the planned excavation is 20 feet or greater.

804.2 SUBMITTALS: Submit any applicable manufacturer’s product data, instructions, recommendations, and certifications.

804.3 EXCAVATION: The Contractor shall perform all excavation of every description and of whatever substances, including rock, encountered to the lines and grades shown in the contract documents or determined by the Engineer. During excavation, material suitable for backfilling shall be stockpiled in orderly manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins. All excavated materials not required or suitable for backfill shall be removed and properly disposed of by the Contractor or as directed by the Engineer. Grading shall be done as may be necessary to prevent surface water from flowing into trenches or other excavations, and any water accumulating therein shall be removed by pumping or by other approved methods.

Sheeting and shoring shall be installed in accordance with all applicable safety requirements for the protection of the work, adjoining property, and for the safety of all personnel. Unless otherwise indicated, excavation shall be by open cut, whether by hand, backhoe, ram-hoe, rock saw, or whatever method as necessary. Short sections of a trench may be tunneled, if in the opinion of the Engineer, the pipe or structure can be safely and properly installed or constructed, and backfill
can be properly compacted in such tunnel sections.

1. **Archaeological (Unidentified Archaeological Sites):** If the Contractor should encounter a section of an archaeological feature, such as a acequia (early Spanish irrigation ditch) or any other archaeological deposits during construction operations, the Contractor must stop excavation immediately and contact the SAWS Inspector, who will call the City Historic Preservation Officer at (210) 299-8303 for an archaeological investigation as per Section 35-432.3 of the City Code, “Unidentified Sites Archaeological.” The Contractor cannot begin excavation again without written permission from SAWS. If more than three days are required for investigation (not including holidays and weekends) and the Contractor cannot work on other project scope items, the Contractor will be permitted to negotiate for additional construction time. The Contractor shall submit a request in writing within ten days after date of the first notice. If the time required for investigation does not exceed three days for each event, contract duration will not be extended.

2. **Safety Devices:** The Contractor shall provide and maintain barricades, flags, torches, and other safety devices as required by local, state, and federal codes and ordinances and conduct work to create a minimum inconvenience to the public. Temporary suspension of work does not relieve responsibility for the above requirements.

3. **Safety and Health Regulations:** The Contractor shall at all times conform to all of the latest applicable regulations of Subpart “P” entitled “Excavation, Trenching, and Shoring of OSHA Safety and Health Regulations for Construction,” or most applicable approved equal provisions, and all other applicable state and local rules and regulations.

**804.4 TRENCHING:**

1. Trench walls shall be vertical. The practice of undercutting at the bottom or flaring at the top will not be permitted except where it is justified for safety or at the Engineer’s and/or Inspector’s direction. In special cases, where trench flaring is required, the trench walls shall remain vertical to a depth of at least 1 foot above the top of the pipe.

   The trench bottom shall be square or slightly curved to the shape of the trenching machine cutters. The trench shall be accurately graded along its entire length to provide uniform bearing and support for each section of pipe installed upon the bedding material. Bell holes and depressions for
joints shall be dug after the trench bottom has been graded and bedding installed. The pipe shall rest upon the new bedding material for its full length.

Where over-excavation occurs and where not as directed by the Engineer or Inspector, the under-cut trench shall be restored to grade at no cost to SAWS by replacement with a material conforming to the requirements of the bedding material or a material approved by the Engineer.

The depth of cuts indicated on the cut sheets, as furnished by the Engineer, are from the off-set or cut hub elevation to the invert, or as indicated otherwise therein.

Minimum Width of Trench: The minimum width of pipe trenches, measured at the crown of the pipe, shall be not less than 12 inches greater than the exterior diameter of the pipe, exclusive of bells. The minimum base width of such trench shall be not less than 12 inches greater than the exterior diameter of the pipe, exclusive of special structures or connections. Such minimum width shall be exclusive of trench supports and not greater than the width at the top of the trench.

Maximum Width of Trench: The maximum allowable width of trench for pipelines measured at the top of the pipe shall be the outside diameter of the pipe (exclusive of bells or collars) plus 24 inches. A trench wider than the outside diameter plus 24 inches may be used without special bedding if the Contractor, at his sole expense, furnishes pipe of the required strength to carry additional trench load. Such modifications shall be submitted to the Inspector and approved in writing. Whenever such maximum allowable width of trench is exceeded, except as provided for in the contract documents, or by written approval of the Engineer, the Contractor, at his sole expense, shall encase the pipe in concrete from trench wall to trench wall, or with other approved pipe bedding material. Any excavation wider than this maximum width or subsequent surface or paving work, will be done at the Contractor’s sole expense.

The depth of cut as indicated on the cut sheet for pay purposes may be more or less than the actual excavated depth. The variation is based on the surface elevation prior to the Contractor’s operation and the invert of the sewer line.

2. When unsuitable bearing materials such as water, silt, muck, trash, debris or rock in ledge, boulder or coarse gravel (particle size larger than 1- ¾
inch) is encountered at the bearing level, the Contractor shall over-excavate and remove such materials to a depth no less than 6 inches below the bottom of the pipe and replace it with a material conforming to the requirements of Paragraph 804.5.2.a, 804.6, or as approved by the Engineer and/or Inspector.

3. **Dewatering:** Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding project site and surrounding area.

   a. The Contractor shall not allow water to accumulate in excavations or at subgrade level. Remove water to prevent softening of foundation bottoms and soil changes detrimental to stability of subgrades and foundations. Provide and maintain dewatering system components necessary to convey water from excavations.

   b. Convey water removed from excavation and rainwater to collecting or runoff areas away from buildings and other structures. Establish and maintain temporary drainage ditches and other diversions outside excavation limits. Do not use trench excavations as temporary drainage ditches.

   c. Dewatering devices shall be provided by the Contractor with filters to prevent the removal of fines from the soil. Should the pumping system draw fines from the soil, the Inspector shall order immediate shutdown, and remedial measures will be the responsibility of the Contractor.

   d. Upon completion of the dewatering work, the Contractor shall remove all equipment and leave the construction area in a neat, clean, condition that is acceptable to the Inspector.

   e. The Contractor shall maintain groundwater table at least 12 inches below the finished excavation subgrade.

   f. Dewatering Performances. Performances of the dewatering system for lowering groundwater shall be measured by observation wells on piezometers installed in conjunction with the dewatering system, and these shall be documented at least daily. The Contractor shall maintain a log of these readings and submit them to the Inspector.
804.5 BACKFILLING SANITARY SEWER TRENCHES:

1. **General**: Trenches shall not be backfilled until the construction structures or appurtenances, as installed, conform to the requirements specified. Where specified, only the secondary backfilling may incorporate excavated materials approved for backfilling, consisting of earth, loam, sandy clay, sand and gravel, soft shale or other approved materials, free from large clods of earth or stones. Where pipe is specially coated or sleeve/tape wrapped for protection against corrosion, care shall be taken not to damage the coating or sleeve/tape wrap.

Where a trench has been improperly backfilled, or where settlement occurs, the identified section shall be excavated to a depth and length 50 feet beyond the failed area, then refilled and compacted to the grade and compaction level required. The use of sand backfill shall not be allowed. All compaction within the secondary backfill zone shall be such that the apparent dry density of each layer shall be not less than 98% from the top of the initial backfill to the bottom of pavement section. The pavement (asphalt) section shall have 95% compaction density with a maximum dry density at + or – 2% optimum moisture content as determined by tests on samples as outlined in the latest provisions of TX-DoT Testing Method Tex 113-E or most applicable approved equal provisions, unless otherwise shown on the contract documents. At the time of compaction, the water content shall be at optimum moisture content, + or - 2% points.

See Table 1 at the end of this specification for an outline of the bedding and initial backfill requirements for various pipe types.

2. **Sanitary Sewer Backfilling**: Backfilling for sanitary sewers is divided into three (3) separate zones: (a) bedding: the material in the trench bottom in direct contact with the bottom of the pipe; (b) initial backfill: the backfill zone extending from the surface of the bedding to a point 1 foot above the top of the pipe; and (c) secondary backfill: the backfill zone extending from the initial backfill surface to the top of the trench. Materials and placement for each of the zones shall be as described herein.

a. **Bedding**: 

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No direct payment shall be made for costs associated with dewatering. All costs in connection therewith shall be included in the applicable contract price for the item to which the work pertains.
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(1) Stable Material: Existing stable material present during excavation includes:

Trench bottom (free of water, muck, debris);

Rock in boulder, ledge or coarse gravel (particle size not larger than 1-3/4 inch) formations;

Coarse sand and gravels with maximum particle size of 1-3/4 inch, various graded sands and gravels containing small percentages of fines, generally granular and non-cohesive either wet or dry; and

Fine sands and clayey gravels; fine sand, sand-clay mixtures, clay and gravel-clay mixtures.

(2) Unstable Material: Existing unstable materials are silt, muck, trash or debris in the trench bottom bearing level; rock on boulder ledge or coarse gravel (particle size larger than 1-3/4 inch) formations.

(3) Bedding Material: The existing material at the bearing level shall be removed and replaced to a minimum depth of 6 inches or 1/8 of the outside diameter of the pipe, whichever is greater, with bedding material. The bedding material shall extend up the sides of the pipe sufficient to embed the lower quadrant of the pipe. The bedding material shall be composed of well-graded, crushed stone or gravel conforming to the following requirements unless modified by the Engineer in writing.

<table>
<thead>
<tr>
<th>Sewer Gravel</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passing 1-1/2 inch sieve</td>
<td>100</td>
</tr>
<tr>
<td>Passing 1 inch sieve</td>
<td>95 to 100</td>
</tr>
<tr>
<td>Passing 1/2” inch sieve</td>
<td>25 to 60</td>
</tr>
<tr>
<td>Passing No. 4 sieve</td>
<td>0 to 10</td>
</tr>
<tr>
<td>Passing No. 8 sieve</td>
<td>0 to 5</td>
</tr>
</tbody>
</table>

(4) Over Excavation: Where the trench bottom has been over
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excavated beyond the limits as defined in Item No. 848, “Sanitary Sewers,” due to removal of unstable material, the pipe shall be concrete-encased. Encasement shall extend from the trench wall to trench wall and be a minimum of 6 inches above the top of pipe. No separate pay item (See Item No. 858).

(5) Reduced Excavation: Where the trench bottom is not excavated in accordance with the specification due to rock or other hard under lying materials, then the pipe shall be concrete encased as defined in Item No. 858, “Concrete Encasement.”

(6) Consolidating Backfill Material: The Initial Bedding material shall be consolidated to assure it is incorporated from the bottom of the trench up to the pipe centerline. A hand-held vibrator, commonly used for concrete work, can be used for this purpose. The vibrator shall be inserted every 3 feet on each side of the pipe.

b. Initial Backfill: Initial backfill is defined as backfill having a thickness in its compacted state from the surface of the bedding to a point 1 foot above the top of the pipe.

Initial backfill shall consist of gravel which conforms to the requirements of Item No. 804.5.2. a (3).

For sewer lines up to 24 inches in diameter initial backfill material shall be placed in two separate lifts above the bedding material the pipe is set on. The first lift shall be spread uniformly and simultaneously on each side and under the bottom quadrant of the pipe to the mid-point or spring line of the pipe.

Consolidate the Initial Backfill material as per section 804.5.2.(6).

Placement of the first lift of initial backfill shall be subject to inspection and approval prior to placement of second lift, which shall extend from the spring line of the pipe to a minimum of 1 foot above the top of the pipe. The second lift shall be evenly spread in a similar manner as the first lift.

For diameters larger than 24 inches, initial backfill material shall
be evenly and simultaneously spread alongside, under the lower quadrant the pipe and over the pipe in 12 inch lifts to a point sufficient to a minimum of 1 foot above the top of the pipe.

Consolidate the Initial Backfill material as per section 804.5.2.(6).

c. Secondary Backfill: Secondary backfill is defined as backfill from 1 foot above the top of the pipe to the top of the trench or bottom of pavement section. Secondary backfill shall be constructed in accordance with details shown in the construction documents.

Secondary backfill shall generally consist of materials removed from the trench and shall be free of brush, debris and trash. Rock or stones having a dimension larger than 6 inches at the largest dimension shall be sifted out and removed before the material is used in the secondary backfilling zone. Secondary backfill material shall be primarily composed of compactible soil materials. The secondary backfill material shall be placed in maximum 12 inch loose lifts or as directed by the Design Engineer and/or Inspector.

d. Trench Surface Restoration: The surface of the backfilled trench shall be restored to match the previous existing conditions. This shall include final grading, placement of topsoil and seeding, placement of sod (such as at homes or businesses that had maintained grass), or other unprepared and prepared surfaces.

Trenches in alleys actively being used by vehicles (such as trash pickup, vehicle parking, etc.) shall be restored by grading and compacting to 98% or higher with a minimum of 4 inches of flex-base materials for the entire width of the alley. Asphaltic materials shall have a compaction density of 95%. Alleys not actively used by vehicles shall be graded and compacted to 98% or higher from the top of the initial backfill to the bottom of the pavement section, then spread grass seed for entire width of the alley.

Trenches in paved streets shall be covered with a temporary all-weather surface to allow for vehicular traffic until the final asphalt/concrete paving is complete. This surface shall be a minimum of 4 inches compacted and rolled asphaltic black base, either hot-mix or cold-mix applied. It is the Contractor’s
responsibility to maintain this surface until the final street restoration is complete. Temporary street striping may also be required. This surface must be removed prior to final asphaltling. All street work shall be done in accordance with the latest City of San Antonio Public Works’ (or other city as applicable) construction specifications.

Included in this requirement is replacement of any curbs or sidewalks damaged or removed during the construction.

No separate payment for the surface restoration is permitted. The cost for this work must be included in the appropriate bid item.

**804.6 BACKFILLING POTABLE WATER TRENCHES:** Mains and service line trenches shall be excavated in accordance with Item No. 804.3 and Item No. 804.4 for placement of potable water appurtenances.

1. **Bedding/Initial Backfilling:** The bedding and initial backfill materials for concrete steel cylinder pipe (CSC), ductile iron pipe (DI), HDPE Pipe, Wrapped Steel Pipe, and Polyvinyl Chloride Pipe (PVC) in all nominal diameters shall be composed or well graded crushed stone or gravel conforming to the following requirements unless modified by the Engineer.

Modified Grade 5 gravel:

<table>
<thead>
<tr>
<th>MODIFIED GRADE 5</th>
<th>PERCENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retained on ½” sieve</td>
<td>0</td>
</tr>
<tr>
<td>Retained on 3/8” sieve</td>
<td>0-5</td>
</tr>
<tr>
<td>Retained on No. 4 sieve</td>
<td>20-80</td>
</tr>
<tr>
<td>Retained on No. 10 sieve</td>
<td>75-100</td>
</tr>
<tr>
<td>Retained on No. 20 sieve</td>
<td>98-100</td>
</tr>
</tbody>
</table>

The quantity and thickness of materials lifts and compaction of initial backfill materials shall be in accordance with the provisions of Item No. 804.5.2.b and Item No. 804.6.1.

Where copper services (¾” – 2”) copper are installed, initial backfill shall be sand conforming to the following requirements: Natural sand or sand produced from crushed gravel or crushed rock maximum ¼-inch; 95 percent shall pass No. 4 sieve, free from clay and organic material, with a maximum 8 percent passing the No. 200 sieve. Larger services utilizing DI pipe or PVC (C-900) pipe shall be backfilled the same as mains.
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2. **Secondary Backfill:** Secondary backfill materials for all types and sizes of pipe shall be as defined in Item No. 804.5.2. (c), “Secondary Backfill.” Secondary backfill materials shall be placed and compacted in accordance with the provisions of Item No. 804.5.2. (c), “Secondary Backfill.”

3. **Trench Surface Restoration:** Trench surface restoration shall be accomplished as defined in Item No. 804.5.2. (d).

804.7 **DISPOSAL OF EXCAVATED MATERIALS:** Any excess excavated material, not utilized after all fill requirements have been met, shall become the responsibility of the Contractor. The Contractor shall dispose of it by hauling and wasting outside the limits of the rights-of-way or easements of this project and of public thoroughfares and water courses, in conformity with pertinent City, County, State and Federal codes and ordinances and in a manner meeting the approval of the Engineer.

804.8 **QUALITY CONTROL:**

1. The Contractor shall procure, store, and place materials from either onsite or offsite sources which comply with the specified requirements.

2. **Quality Assurance Testing:** The Owner shall have such tests and inspections as he may desire performed by a nationally-accredited, independent testing laboratory for his guidance and control of the work. Payment for such tests shall be the responsibility of the Owner, including the material proctor tests and density tests. The Contractor shall request testing work performed by the Owner by notifying the Owner of the areas available by Station Numbers or Dimensions and Lift Numbers. The Contractor shall provide access to the test area, associated trench excavation safety protection, and backfilling of the test areas. The frequency and location of testing shall be determined solely by the Owner. The Owner may test any lift of fill at any time, location, or elevation.

3. **Quality Control Testing:** The Contractor shall be responsible for compaction in accordance with the appropriate Specification. Compaction tests will be done at one location point randomly selected or as indicated by the SAWS Inspector/Test Administrator, per each 12 inch loose lift per 400 linear feet. The inspector shall determine the depth at which the density test shall be taken. All depths shall be considered for testing without a predetermined maximum or minimum.
Note: Tests requirements above are indicated as a minimum requirement, but maybe subjected to follow more stringent requirements as established by other appropriate agencies (such as City of San Antonio Public Works Right-of-Way Management Plan, etc.).

Note: Any failed test shall require the Contractor to remove and replace that layer of backfill to 50 feet from either side from the failed test location. The Contractor will also be required at no cost to SAWS to provide two additional tests at the replaced location where the initial test failed and at one location point, randomly selected or as indicated by the SAWS Inspector/Test Administrator.

Note: Sanitary Sewer Laterals will be subject to compaction tests at the discretion of the SAWS Inspector/Test Administrator within 400 linear foot segments. Any failed test shall require the Contractor to remove and replace failed backfill. The Contractor will also be required at no additional cost to SAWS to provide one test at the replaced location where the initial tests failed.

The Contractor shall be responsible for all costs associated with the proctor and density tests, and for providing to SAWS and Consultant, if applicable, verification that necessary compaction levels were achieved. These tests shall be performed by a nationally-accredited, independent testing laboratory.

The Contractor shall provide access to the test area, associated trench excavation safety protection, and backfilling of the test areas at the Contractor’s expense.

The Owner will determine in-place density and moisture content by any one or combination of the following methods: The latest provisions of ASTM D2922 (density of soil and soil aggregate in-place by nuclear methods – shallow depth), D1556 (density and unit weight of soil in-place by sand cone method), D2216 (lab density of water content of soil and rock), D3017 (water content of soil and rock – shallow depth in-place by nuclear methods) or most applicable approved equal provisions.

804.9 MEASUREMENT: Excavation, Trenching and Backfill will not be measured for payment.

804.10 PAYMENT: No direct payment shall be made for incidental costs associated with quality control testing, excavation, trenching and backfilling for water mains.
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and sanitary sewers, and all costs in connection therewith shall be included in the applicable contract price for the item to which the work pertains.

### TABLE 1
**BEDDING AND INITIAL BACKFILL REQUIREMENTS**

<table>
<thead>
<tr>
<th></th>
<th>UNSTABLE</th>
<th></th>
<th>STABLE*</th>
<th></th>
<th>ROCK</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bedding</td>
<td>Initial Backfill</td>
<td>Bedding</td>
<td>Initial Backfill</td>
<td>Bedding</td>
</tr>
<tr>
<td>WATER</td>
<td>6&quot; or D/8</td>
<td>1.0' above pipe</td>
<td>6&quot; or D/8</td>
<td>1.0' above pipe</td>
<td>6&quot; or D/8</td>
</tr>
<tr>
<td>CSC</td>
<td>Modified Grade 5</td>
<td>Modified Grade 5</td>
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</tr>
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<td>Modified Grade 5</td>
<td>Modified Grade 5</td>
<td>Modified Grade 5</td>
<td>Modified Grade 5</td>
</tr>
<tr>
<td>SEWER</td>
<td>6&quot;</td>
<td>1.0' above pipe</td>
<td>6&quot;</td>
<td>1.0' above pipe</td>
<td>6&quot;</td>
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<table>
<thead>
<tr>
<th>Material</th>
<th>Grading</th>
</tr>
</thead>
<tbody>
<tr>
<td>gravel</td>
<td></td>
</tr>
</tbody>
</table>

* When the native material encountered is clean sand, this material may be utilized for bedding and initial backfill at the Engineer's direction.

HDPE = High Density Polyethylene Pipe. WSP = Tape Wrapped Steel Pipe.
D = Outside Diameter of Pipe.

Modified Grade 5    ---    rounded rock
                     ---    See Item No. 804.6.1 for gradation
Sewer Gravel        ---    See Item No. 804.5.2. a (3)
**Sewer Gravel 6" Min. or 1/3 O.D. of the pipe, whichever is greater.**

In areas of over excavation, encasement shall extend from trench wall to trench wall. Pay Limits shall not exceed 12" max. as shown on detail. Additional encasement shall be incidental.

**Min 2" HMAC Type "D" for trench repair in Local/Residential streets.**

**Min 3" HMAC Type "C" for trench repair in Collector/Arterial streets.**
1. The Compaction Report will indicate the station and the depth of each test point.

2. When Contractor opts to backfill with approved secondary material, all work will be subject to section 804.5.1 and 804.6.2.C & 2.D.

3. Insure Compaction Probe Penetrates To Same Depth As Lift.

NOTES:

- Initial Backfill
- 12" Loose Lift
- Pipe Sizes Varies
- For Manhole, Refer to SAWS Specification DD-804-01.
- Test Only When Necessary
- See Note 2
- For Backfill Material, Refer to SAWS Specification DD-804-01.