SECTION 5
TRENCH BEDDING, BACKFILL & EXCAVATION

5.01 INDEX

5.01 INDEX
5.02 PURPOSE
5.03 GENERAL
5.04 MATERIALS
5.05 CONSTRUCTION
5.06 FIELD SAMPLING AND TESTING
5.07 BOX/VAULT INSTALLATIONS

5.02 PURPOSE

This specification states the requirements and standards for bedding and backfill soils for pipes and conduits, and for compacting, testing and inspection of bedding and backfill soil in addition to trench configurations and general requirements and guidelines for trenching and excavation for pipe, box, and vault installations within TMWA service territory.

5.03 GENERAL

5.03.01 Standard Test Methods:

The following standard test methods of the American Society for Testing and Materials (ASTM) form a part of this specification, and are referred to herein by alphanumeric designation.

<table>
<thead>
<tr>
<th>ASTM</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>C136</td>
<td>Sieve Analysis of Fine and Coarse Aggregates</td>
</tr>
<tr>
<td>D4318</td>
<td>Liquid Limit of Soils</td>
</tr>
<tr>
<td>D4318</td>
<td>Plastic Limit and Plasticity Index of Soils</td>
</tr>
<tr>
<td>D1556</td>
<td>Density and Unit Weight of Soil In-Place by the Sand-Cone Method</td>
</tr>
<tr>
<td>D1557</td>
<td>Moisture-Density Relations of Soils Using 10-lb. (4.5 kg) Rammer and 18-in (457-mm) Drop</td>
</tr>
<tr>
<td>D2419</td>
<td>Sand Equivalent Value of Soils and Fine Aggregate</td>
</tr>
<tr>
<td>D2844</td>
<td>Resistant R-Value and Expansion Pressure of Compacted Soils</td>
</tr>
<tr>
<td>D6938</td>
<td>Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth)</td>
</tr>
</tbody>
</table>
5.03.02 Substitute Test Method:

Where local practice and conditions prescribe alternate test methods than the ASTM tests listed above, those tests may be substituted for the ASTM designated test method upon written approval from TMWA.

5.03.03 Material Sources:

A. New Sources - The applicant, at his own expense, shall have any bedding and backfill materials from sources previously undeveloped, or unfamiliar to TMWA, tested and certified by an approved, independent materials testing laboratory, per these specifications.

B. Existing Sources - Bedding and backfill materials from sources previously developed and familiar to TMWA may be accepted without testing and certification upon written request by the applicant. TMWA reserves the right to verify the acceptability of all materials proposed for use.

5.03.04 All applicable City, County, State, and Federal Specifications must be met in addition to the requirements of this Standard. In the case of conflict, the more rigid Specification or Standard shall apply.

5.04 MATERIALS

5.04.01 Water Pipe Bedding Sand:

Bedding Sand shall be free of ice, clay, excessive organic matter and other deleterious material, and shall conform to the requirements for Class A Backfill as defined in the Standard Specifications for Public Works Construction, Aggregates for Bedding and Backfill. Refer to TMWA Standard details 10L-6 and 10L-7 for bedding sand zone.

A. Sand Equivalent per ASTM D2419: 25 minimum.

B. Alternate Bedding

Upon prior written approval from TMWA, excavated on-site soil may be utilized as bedding material; approval does not relieve the applicant from meeting the requirements of the remaining Sections of this specification. The alternate bedding soil shall be free of rocks, ice, organic matter and other deleterious.

Alternate bedding material shall be tested at the applicant’s expense and test results submitted to TMWA for review and determination of acceptance or
rejection. Required qualification testing shall consist of ASTM C136, D2419 and D4318.

5.04.02 Criteria for Describing Angularity:

Angular - Particles have sharp edges and relatively plane sides with unpolished surfaces. Examples include particles that resemble arrowheads.

Subangular - Particles are similar to angular description but have rounded edges.

Subrounded - Particles have nearly plane sides but have well-rounded corners and edges.

Rounded - Particles have smoothly curved sides and no edges.

5.04.03 Crush Aggregate Base Course Backfill:

Crushed aggregate base course backfill shall be a crusher-run, mineral aggregate free of ice, clay, excessive organic matter and other deleterious material and shall conform to the requirements for Type 2 Class B Crushed Aggregate Base as defined in the Standard Specifications for Public Works Construction, Aggregates for Base Courses, in addition to the following requirements:

Plasticity Index per ASTM D4318: Allowable Plasticity Index (PI) shall be based on the requirements for Type 2 Class B Crushed Aggregate Base, but shall not be less than five (5) or greater than twelve (12).

Refer to TMWA Standard details 10L-6 and 10L-7 for backfill zone.
5.04.04 Native Backfill:

Native backfill is defined as granular soil excavated from a trench and it shall be free of ice, clay, debris and excessive organic matter. Native backfill soil shall not consist of expansive clay. Native backfill shall conform to the requirements for Class E Backfill as defined in the Standard Specifications for Public Works Construction, Aggregates for Bedding and Backfill.

5.04.05 Substitute Material:

Substitute bedding and backfill materials may only be used if prior written approval from TMWA is received. In requesting the use of a substitute material, the applicant must submit adequate evidence that the material has been successfully used in similar applications for other utilities or local governmental agencies.

5.05 CONSTRUCTION

5.05.01 Trench Configuration:

Typical trench configurations used by TMWA can be found in Appendix 10L. In cases where a typical configuration does not apply, a trench section drawing shall be provided by the applicant and approved by TMWA showing necessary dimensions and details. The following general rules apply to all trenches:

A. Backfill Option: Either crushed aggregate base or bedding sand material may be used for backfill material in the trench area between twelve (12) inches above the pipe and twelve (12) inches below finish grade. In either case, material and compaction shall be in accordance with this Section.

B. Locator Tape and Tracer Wire: Blue locator tape labeled “WATER” shall be placed in all trenches twelve (12) inches above TMWA pipe where water is not joint trench with gas. Where water is in a joint trench with gas blue locator tape labeled “WATER” shall be placed twelve (12) inches above gas in addition to locator tape requirements set by the gas utility. Metallic locator tape must be utilized with water facilities when there is no other detectable means available.

In trenches where only water pipe is installed, tracer (conductive) wire will be installed with the TMWA pipe. The wire shall be taped to the main and located on the side or bottom of the pipe. At least one (1) three (3) pound magnesium anode will be attached to the wire to improve grounding. A maximum of five hundred (500) feet of tracer wire may be laid in the trench with test stations every five hundred (500) feet. See Appendix 10L for design details.
C. Gas and Water Installation Sidewall Clearances, Sand Bedding and Separation: Sidewall clearances are twelve (12) inches each side for sizes six (6) inches through twelve (12) inches. Sand bedding is six (6) inches for size six (6) inch through twelve (12) inch. Separation for pipes in joint trenches is twelve (12) inches for sizes six (6) inch through twelve (12).

5.05.02 Material Installation/Repair:

Conduits, pipes, and all apparatus shall be handled, installed, and joined in accordance with TMWA’s construction standards, and the manufacturer’s specifications or recommendations. The applicant, at his own expense, shall repair or replace any conduits, pipes or appurtenances damaged from handling, installing, joining during bedding and backfill operations.

5.05.03 Bedding Sand Compaction:

Bedding sand material, conforming to 5.04.01, shall be placed in twelve (12) inch maximum loose lifts and compacted to ninety (90) percent of the maximum dry density within ± two (2) percent of the soil’s optimum moisture content per ASTM D1557, and the bedding sand shall be stable under the compacting equipment.

5.05.04 Backfill Compaction:

A. Within Public Rights-of-Way - Trenches in established streets, highways, or private paved areas subject shall be backfilled with crushed aggregate base course, conforming to Section 5.04.03, and shall be placed in twelve (12) inch maximum loose lifts and compacted to ninety (90) percent of the maximum dry density within ± two (2) percent of the soil’s optimum moisture content per ASTM D1557, except the top twelve (12) inches which shall be compacted to 95 percent maximum dry density within ± two (2) percent of the soil’s optimum moisture content per ASTM D1557. Developers or the engineer of record are responsible for required compaction tests to verify in-place density and degree of compaction. Minimum cover over water mains shall be thirty six (36) inches.

B. Within Private Property - Trenches in private property and in undeveloped areas not subject to vehicular or pedestrian traffic may be backfilled with Native Backfill, conforming to Paragraph 5.04.04. Native Backfill shall be placed in twelve (12) inch maximum loose lifts and compacted to 85 percent maximum dry density per ASTM D1557. Minimum cover over water mains shall be thirty six (36) inches.

C. Within Utility Easements - Trenches in utility easements that will be overlain with vaults or similar equipment are to be constructed shall be
backfilled in accordance with the Utility Owner requirements. Minimum cover over water mains shall be thirty six (36) inches.

5.05.05 Compaction:

All compaction shall be by hand-operated, plate-type, vibratory, or other suitable hand-tampers in areas not accessible to larger rollers or compactors. Extreme care shall be taken to avoid damage to conduits, pipes, and any appurtenances. Water densification by inundation or jetting shall not be permitted without prior written approval from TMWA.

5.05.06 Trench Dewatering:

Where groundwater is encountered during trench excavation, it shall be the responsibility of the applicant to adequately dewater the trench to provide for safe and convenient installation of pipe or conduit. The applicant shall dewater the trench sufficiently to meet the compaction requirements of Paragraphs 5.05.03 and 5.05.04. Dewatering shall continue until backfill has progressed to a minimum of two (2) feet above the groundwater level. TMWA's Inspector(s) may require drain rock. Drain rock shall conform to Class C Backfill as defined in the Standard Specifications for Public Works Construction, Aggregate for Bedding and Backfill, in addition to the bedding depending on conditions of trench foundation soil. Where drain rock is installed it shall be overlain with a suitable geotextile fabric to limit migration of bedding material.

5.05.07 Finish Operations:

A. Fine Grading - After backfilling, all trenches except those in existing paved areas shall be graded flush with adjacent finish or subgrade elevations.

B. Temporary Patching - Unless otherwise specified, all pavement cuts shall be temporarily patched with asphalt concrete to a minimum depth of two (2) inches, with the finish grade one half (1/2) inch above the grade of the existing asphalt.

C. Disposition of Excess Materials - Surplus excavated soils, asphalt pavement, concrete and other debris shall be promptly removed from the jobsite and properly disposed of off-site. Remaining pavements and concrete flatwork shall be swept broom cleaned.
5.05.08 Other Utilities/Facilities

A. Joint Trenches: Joint trench construction shall be by mutual agreement of all parties involved. Coordination of separate utility/facility installations in a joint trench shall be by the applicant.

B. Customer facilities (except fuel/sewage/leach lines) may be installed in a joint trench if the following conditions are met.

   1) Installation is approved by all the utilities involved
   2) All clearances are met, and
   3) On private property.

No customer facilities will be allowed in joint trenches in franchised right-of-ways.

C. Existing Utilities: Prior to commencement of excavation, the applicant shall telephone the Underground Service Alert (USA) at 1-800-227-2600. After existing utilities have been located, extreme caution shall be exercised while excavating in their vicinity. Once exposed, pipes, conduits, and cable shall be shored or supported as necessary to prevent damage. The full cost of repair or replacement of damaged utilities shall be borne by the applicant.

5.05.09 Installation Procedures

Pipes shall be installed in the trench, in accordance with the manufacturer’s recommended procedures, TMWA Specifications, and/or Standards and accepted practices.

5.06 FIELD SAMPLING AND TESTING

5.06.01 Materials Testing:

The applicant, at his own expense, shall retain the services of an approved, independent materials testing laboratory to perform the following tests:

A. Moisture-Density Relations - The bedding and backfill soil shall be tested for their moisture-dry density relations per ASTM D1557.

B. Density Tests - The bedding and backfill soil shall be tested for their in-place dry density per ASTM D1556 or D2922. Test locations will be randomly selected by TMWA. The following frequencies shall apply:

   1) Bedding Sand - Tests shall be made at a minimum of one test per lift per five hundred (500) lineal feet of trench.
2) Crushed Aggregate Base Course Backfill - Tests shall be made at a minimum of one test per lift per five hundred (500) lineal feet of trench.

C. Tests will be reported by specific location: Ex. Site 1: bedding sand test @ three (3) feet below finish grade at station number _______.

5.06.02 Retesting:

If any test conducted fails, the lift shall be recompacted and two additional tests shall be performed. Test locations will be randomly selected by TMWA at applicant’s expense.

5.06.03 Reporting:

The results of all tests shall be submitted to TMWA within twenty-four (24) hours after the completion of the test.

5.06.04 Exceptions:

At remote locations or for small installations, as determined by TMWA, the sampling and testing procedures in Paragraph 5.06.01 may be reduced or waived by TMWA. Such waiver does not relieve the applicant from meeting the requirements of the remaining Sections of this specification.

5.07 BOX / VAULT INSTALLATION

5.07.01 Application

Selection of the correct type of box or vault involves judgment, taking into account the present and future intended traffic use for the area where the box will be located.

A. Incidental Traffic: For use in sidewalks, pedestrian traffic areas, driveways in residential subdivisions and parkway strips. Incidental Traffic Boxes are not to be installed in traveled public thoroughfares, i.e. highways, streets, bridges.

B. Full Vehicular Traffic: For use in streets, driveways, parking lots where heavy vehicular traffic is expected.

C. Non-Traffic: For use in areas where there is no current or future exposure to any type of vehicular traffic.
5.07.02 Excavation

Excavation for boxes/vaults shall be performed by the contractor or customer concurrent with adjacent trench excavation, unless otherwise directed by the TMWA Engineer, Project Coordinator, or Inspector. Size, depth, and alignment of the excavation shall be as shown on the TMWA approved design drawings.

5.07.03 Dewatering

Refer to Section 5.05.06.

5.07.04 Installation

Boxes/vaults shall be installed using equipment with adequate load capacity to safely handle the components. No personnel shall be in the excavation during placement. All boxes and vaults shall be set level, squarely aligned with existing or proposed improvements and with the top two tenths of a foot (0.20’) above finish grade in unpaved areas, one quarter of an inch (0.25”) below finish grade in paved areas, and flush in sidewalks and other concrete areas.

5.07.05 Bedding and Backfill

Vaults shall be bedded and the surrounding excavation backfilled with bedding sand or Type 2 Class B aggregate base per this Section and compacted to ninety (90) percent surrounding the vault to twenty four (24) inches outside the vault.

5.07.06 Miscellaneous

A chamber, vault, pit or manhole that contains any valves, including blowoff valves, or any meters or other appurtenances of a distribution system must not be connected directly to any sanitary sewer or storm sewer; and except for meter boxes for service lines and valve boxes for water mains, must be drained to the surface of the ground or to a subsurface drainage field.