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SPECIFICATIONS -DETAILED PROVISIONS
Section 02221 –Trenching, Backfilling, and Compacting

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**SECTION 02221
TRENCHING, BACKFILLING, AND COMPACTING**

PART 1 -GENERAL

1.01 SUMMARY

- A. Trench, backfill, and compact as specified herein and as needed for installation of underground utilities associated with the work.
- B. Verification of Existing Conditions. It shall be the responsibility of the Contractor to examine the site of the work and to make all investigation necessary, both surface and sub-surface, to determine the character of materials to be encountered and all other existing conditions affecting the work.
- C. Lines, Grades and Measures. All lines and grades will be established by the Engineer, and the Contractor shall provide him with such assistance and materials as may be required. The Contractor shall carefully preserve all survey stakes and reference points. Should any stakes or points be removed or destroyed by any act of the contractor or his employees they may be reset at the contractor's expense.
- D. Compliance with Regulations. The Contractor shall familiarize himself, and comply with all applicable federal, state, county and municipal rules and regulations pertaining to sanitation, fire protection, surface and ground water quality and safety.
- E. Contractor's Equipment. The Contractor shall provide such modern plant and equipment as may be necessary in the opinion of the Engineer to perform in a satisfactory and acceptable manner, and in accordance with the specifications, all the work required of the Contractor.
- F. Representatives for Emergencies. The Contractor shall file with the District a written list giving the names, addresses, and telephone numbers of at least two (2) of his representatives who can be contacted at any time in case of emergency. The representatives shall be fully authorized and equipped to correct unsafe or inconvenient conditions on short notice. The Contractor shall promptly notify the District of all changes in the listing.
- G. Water Supply. The Contractor may obtain water for work under this specification from the sources as stated in the Special Provisions and Requirements of this specification.

1.02 STRUCTURE PROTECTION

- A. Contract Drawings. The drawings identify the various pipes, conduits, and other existing utility structures as they are supposed to exist in construction areas, but no error or omission on said drawings shall be construed to relieve the Contractor from the responsibility of protecting any such pipe, conduit, or other existing utility structures.

When deemed necessary by the Engineer, revisions of the contract drawings and additional detailed drawings will be issued to the Contractor during the progress of the work.

- B. Notification of Underground Service Alert of Southern California. When performing underground work, the Contractor shall call Underground Service Alert (USA), the one-call underground facility locating service, two (2) working days prior to making an excavation. Contractor shall be responsible for such notification of sub-contractor's work, or shall require sub-contractor to assume this responsibility.
- C. Identification and Verification of Underground Utility Markings. Contractor shall keep a list of all utilities that were identified by USA, the contract drawings, or surface evidence to be in the vicinity of excavation activities and verify that the owner of identified utilities responded to the USA notification by either marking the location of their utility, marking that there were no utilities in the vicinity of the marked excavation or by utility owner representative direct contact with the contractor. Excavation shall not proceed until this verification is demonstrated to the Engineer.
- D. Potholing. The Contractor shall make its own investigation including exploratory excavation and potholing, to determine the location and type of utilities and service connections prior to commencing work which could result in damage to such utilities. The Contractor shall immediately notify the District in writing of any utility discovered in a different location than shown on the plans or which is not shown on the plans.
- E. Operation of Utilities. No District valves, or appurtenances of other utility facilities shall be operated by the Contractor without approval and/or instruction from the District or the utility, as appropriate.
- F. Damage to Structures. If any utility or structure is damaged by the Contractor, the Contractor shall immediately stop work in the vicinity of the damaged utility or structure, contact the utility or structure owner, and not resume work in the vicinity of the damaged utility or structure until the utility owner deems it safe to proceed. Any costs associated utility or structure damage shall be the responsibility of the contractor.

1.03 JOB CONDITIONS

- A. Safeguarding Excavations and Property. Excavations shall be adequately shored and braced so that the earth will not slide or settle and so that all existing improvements of any kind will be fully protected from damage. Any damage resulting from a lack of adequate shoring and bracing shall be the responsibility of the Contractor. The Contractor shall affect all necessary repairs or reconstructions at the Contractor's own expense as directed by the Engineer and shall bear all other expenses resulting from such damage.
- B. Safety Measures. Each bid proposal submitted under these specifications for the construction of a pipeline, sewer, sewage disposal system, boring and jacking pits, or similar trenches or open excavations, or the use of such a trench or open excavation, shall include in appropriate bid items for such work the costs necessary to provide adequate sheeting, shoring, and bracing, or equivalent method for the protection of life or limb, which shall conform to applicable safety orders, including the Construction Safety Orders of the California Division of Industrial Safety, in accordance with the requirements of the California Occupational Safety and Health Act.

[**Note: Tunneling requires a designation of gas potential **prior** to bid. **]

1.04 GUARANTEE

The Contractor hereby guarantees that the entire work constructed by him under the contract will fully meet all the requirements thereof as to quality of workmanship, and of materials furnished by him.

PART 2 -PRODUCTS

2.01 MATERIALS

- A. Select Backfill Material, and Special Bedding and Backfill. Select backfill material shall be selected from the excavated material or imported when not available from the excavated material. In either case, it shall be provided at the Contractor's expense, and shall be included in the costs proposed for pipeline installation on the bidding sheets.

Provide soil materials free from organic matter and deleterious substances, containing no rocks over 3" in greatest dimension, and with no more than 15% of the rocks over 2" in their greatest dimension.

Where called for on the plans or in these specifications, and not covered by a separate bid item, special bedding or backfill shall be included in pipeline construction costs on the bidding sheets.

Where required by the governing agency or by the District to meet compaction requirements of these specifications, or requirements of these specifications for

bedding or for select granular backfill, special bedding or imported backfill and disposal of excavated spoil shall be provided at the Contractor's expense.

The requirements for special bedding and backfill at the Contractor's expense as described herein as a part of the Special Conditions or as shown on the Contract Drawings shall supersede and take precedence over any and all other requirements for measurement and/or payment for special bedding or backfill found elsewhere in these specifications. Bedding is defined herein to include sand, rock or concrete base, cradle, or encasement. Backfill material is defined herein to include backfill for both trench backfill and pipe bedding (or pipe zone backfill).

Special bedding or backfill not called for on the plans or in these specifications, but required by the Engineer over and above the requirements of this specification, shall be constructed at additional cost, at prices reflecting current material costs as evidenced by paid vouchers, plus 50% to cover all costs of installation and overhead.

The encounter of ground water not anticipated in engineering reports made available for this contract, and the required over-excavation and construction of a stable base as determined necessary by the Engineer shall be considered over and above the requirements of this specification, and the required base shall be paid for at the above stipulated prices.

PART 3 -EXECUTION

3.01 WEATHER LIMITATIONS

Excavating and grading shall be performed only when the weather conditions do not adversely affect the quality of the finished product. Any graded or excavated areas that are damaged by the effect of rain, or other weather conditions, during any phase of the construction, shall be re-excavated, re-graded, and re-compacted to conform to the herein specified requirements, without additional cost to the District.

3.02 PREPARATION

- A. Control of Water. The Contractor shall acquire such permits and take such measures as may be required, and shall furnish, install, and operate such pumps or other devices as may be necessary to remove any seepage, storm water, or sewage that may be found or may accumulate in the excavations during the progress of the work. The Contractor shall keep all excavations entirely free from water at all times during the construction of the work and until the Engineer gives permission to cease pumping.

He shall keep the complete work reasonably free from accumulations of water and sewage, and shall free it entirely at such times as may be required by the

Engineer for inspection or other purposes. Any accumulated water or sewage thus pumped shall be disposed of in accordance with good practice and local Ordinances.

The Contractor shall provide an adequate dewatering system for the control of surface and groundwater seepage and leakage past isolation (shut down) valves into the excavations as may be required during the construction period. The proposed plan of this dewatering system shall be submitted to the Engineer for concept approval prior to the installation of the system.

The Contractor is responsible for obtaining a NPDES permit for any groundwater extraction discharges and is responsible for all costs associated with this permit. Water removed from the excavation shall be disposed of in such a manner that it will not cause any damage to public or private property or will not be a menace or inconvenience to the public.

3.03 CONSTRUCTION

- A. Excavation. The Contractor shall perform all excavation necessary or required for the construction of the facilities covered by these specifications. Excavations may be performed by either hand or machine methods and shall be of sufficient size to provide adequate space for working in accordance with safety regulations and practice and the Contract Drawings. Excavations shall include the removal and disposal of all materials of whatever nature and quantity including water, rock, decomposed granite, or any other type of soil or material, subsurface obstructions and also overhead obstructions which may interfere with the operation of equipment used on the work. Excavation for foundations shall be made only after construction of subgrade, as hereinafter described, has been completed. Over excavation for foundations shall be filled with concrete.
1. Trench Excavation. Unless otherwise specified in the Special Conditions or on the Contract Drawings, pipeline trenches shall have a minimum clear distance of 6" and a maximum of 10" on each side of the pipe barrel when the pipe is properly placed and aligned in conformity with the Contract Drawings.

The maximum length of trench which shall be opened or partially opened at any one time shall be limited to 500' for sewer lines and one-half mile for water pipelines, except where governed by other agencies or approved by the Engineer. Bell holes or depressions shall be dug by hand at the proper locations of sufficient size to adequately work the joints, but no larger than is required. Unless approved in writing by the Engineer, all extractions shall be backfilled by the end of the Contractor's shift and prior to the contractor leaving the site unattended.

If a trench is approved by the Engineer to be left open, unattended by the Contractor, then the public shall be protected from the hazards of the trench by approved controls such as steel plates, barriers, and markings. Such

controls shall be proposed by the Contractor in a submittal that includes details of installation and maintenance of such controls.

When the trench is excavated to the line and grade as shown on the drawings, and the bedding material encountered is rock, the trench shall be excavated an additional depth of at least 4" below the grade for the bottom of the pipe, and the bottom of the trench shall be refilled with approved material, moistened and compacted by tamping or by other approved method to the satisfaction of the Engineer.

Where ground water is encountered and the native material does not afford a solid foundation for pipe subgrade as specified above, the Contractor shall excavate to such depth below subgrade as determined necessary by the Engineer and shall construct a stable base by placing crushed rock bedding upon which subgrade can be prepared. Crushed rock for bedding shall be one and one-half inch (1 1/2") maximum size.

When the trench has been inadvertently excavated below the designed grade, at the Contractor's expense, the bottom of the trench shall be refilled with approved material, well compacted into place in an approved manner and to the satisfaction of the Engineer.

Where it becomes necessary to excavate beyond the limits of normal excavation lines in order to remove boulders or other interfering objects, backfill the voids remaining, as directed by the engineer but not less than 90% of maximum compaction. This work is to be done at no extra cost to owner. Where trenching occurs in existing turf areas, remove turf in sections and keep roots damp. Replace turf upon completion of backfilling.

2. Cover. Provide minimum trench depth indicated below to maintain a minimum cover over the top of each listed utility, unless otherwise indicated in specifications or on the drawings.

- a) 1. Water lines: 48"
- b) 2. Gas lines: 24"
- c) 3. Electrical lines: 36"

3. Excavated Materials. Shall be piled neatly along the side of the trench and adjacent to manhole excavations in such a manner as to be of as little inconvenience as possible to the public traffic or the occupants of the adjacent property.

Through all cultivated areas, topsoil removed from excavations shall be replaced as backfill in the uppermost part of the excavation to a depth as it existed previous to excavation, not exceeding 18". Where topsoil replacement is required, excavated topsoil shall be stored separately from other materials and in general shall be replaced as backfill in the same parcel of land from which it came.

4. Disposal of Excavated Materials. Insofar as space is available in the right-of-way, such space may be used for temporary storage of excavated material, to be used for backfill, provided that no material shall be stored or deposited in violation of any ordinance or regulation prohibiting the filling or obstructing of water courses in drainage channels. All materials removed from the excavations in excess of that stored temporarily as above specified shall be immediately hauled away and used in backfilling elsewhere, or, if not used, shall be disposed of by the Contractor. The disposal area shall be acquired by the Contractor.

No materials shall be disposed of either temporarily or permanently on privately or publicly owned property unless the Contractor shall first obtain permission therefore from the owner or agency concerned. The Contractor shall furnish satisfactory evidence to the Engineer that such consent has been obtained and shall be responsible for all damages and claims that may arise in connection therewith.

5. Bracing and Shoring. The Contractor shall furnish, place and maintain such bracing and shoring as may be required to support the side of the excavations for the proper protection of workmen, to facilitate the work and prevent damage to the pipes and manholes being constructed, and to prevent damage to adjacent structures or facilities. Such bracing and shoring shall be verified by the Engineer to be consistent with the excavation support system as presented in an approved submittal. At no time shall anyone be allowed to enter a trench prior to such verification. Upon completion of the work, all bracing and shoring shall be removed unless otherwise directed or permitted by the Engineer.

- B. Fill, Backfill and Grading shall include all scarifying, moistening, compacting, and other manipulations of the soil necessary to obtain the required densities, cross sections, lines, grades and surface finish indicated or specified.

Backfill shall not be placed in trenches or excavations until the pipelines and structures in the particular section involved have been inspected and approved for backfilling by the Engineer.

All excavations outside the completed pipelines and structures shall be backfilled with compacted material to the level of the original ground surface unless otherwise shown on the drawings or ordered by the Engineer. The materials used for backfill shall be imported, selected material, or approved selected excavated materials and shall be placed as directed by the Engineer. All materials placed within 6" of the pipe or structure shall be free from rocks or boulders larger than 1 1/2" maximum dimension, and from unbroken masses of earthy materials which might lodge and thereby cause unfilled pockets in the excavation.

Unsuitable material encountered at the surface upon which the bedding material is to be placed shall be removed to a depth as determined in the field by the Engineer. Unsuitable material shall be as determined by the Engineer. If not otherwise specified, removal of material and additional bedding so ordered over

and above the amount required will be paid for in accordance with the specifications unless, however, the necessity for such additional bedding materials has been occasioned by an act or failure to act on the part of the Contractor, in which event the Contractor shall bear the expense of the additional excavation and backfill to the required depth. The Contractor's attention is called to "dewatering" procedures to ensure that an otherwise stable foundation will not be rendered unfit due to accumulation of water in the trench excavation.

Imported materials (if any) required for fill or backfill shall be provided by the Contractor from areas outside the site at his own expense. Such material shall be as herein specified and must be approved by the District before delivery to the site.

1. Structure Backfill. The Contractor shall place all backfill about structures to the original ground level, or to the lines shown on the drawings or prescribed by the Engineer. Fill materials shall be of earth only, and free from debris, vegetation, alkali, or other deleterious substances.

All backfill about structures shall be placed in layers not more than 6" thick prior to compaction, which shall be obtained by moistening to optimum moisture content prior to placing and compacting to maximum compaction by use of suitable equipment approved by the Engineer.

The Contractor shall take all necessary precautions to protect the structure and underground facilities during the placement, compacting or consolidating, and grading of backfill.

2. Pipeline Backfill. Except as otherwise required by the construction plans or the standard drawings, the material used in backfilling to 1' above the pipe shall be cohesionless, sandy, or sandy gravel material obtained from required excavation or from approved borrow areas, as shown on the Contract Drawings or as directed by the Engineer. This material shall be carefully placed and compacted to provide a firm continuous bedding and encasement for the pipe. Pipe shall be shaded the same day it is laid to protect it from possible damage and/or thermal expansion. Pipe zone backfill shall be consolidated by mechanical tamping.

Deposit approved backfill and bedding material, in the lower portion of the trench, in layers of 6" maximum thickness, and compact with suitable mechanical tampers to a density not less than 85%, or grade as specified in special conditions of contract, until there is a cover of not less than 24" for sewer lines and 12" over other utility lines. Care must be taken to not damage the pipe.

The remaining trench backfill shall consist of select backfill material from the excavation, when available, free from stones or lumps exceeding 3" in greatest dimension, and free from vegetable matter or other unsatisfactory material. This select material as defined herein and elsewhere in these

specifications, shall be placed in layers not exceeding 9" in depth, unless otherwise directed by the Engineer. Each lift shall be consolidated in such a manner that the backfill will meet the requirements of 90% maximum compaction. Care shall be taken not to disturb the backfill previously placed, and the Contractor shall at all times protect the pipe against flotation. All material from failed test to successful test shall be removed, re-compacted and retested.

3. Compacting and Surfacing. Except as otherwise specifically required by the encroachment permit or elsewhere in these specifications, the following requirements will apply:

The upper portion of the final lift will be backfilled with selected material from the excavation, moistened to optimum moisture content and compacted by mechanical tamping to meet the requirements of the District standards, of 95% maximum compaction. All backfill in public roads shall be consolidated and surfacing shall be placed to meet State of California and Riverside County requirements as stated in the respective permit, whether or not required by the inspector for that particular agency -unless otherwise approved by the Engineer.

Where backfill is in areas not within public roads, it shall be consolidated and tested to meet the requirements of these specifications, except as otherwise approved by the Engineer.

Minimum acceptable field densities specified in District standards shall be determined in accordance with the testing procedures set forth elsewhere in these specifications.

Where sand material of an approved grade is used for backfilling, mechanical compaction may be eliminated and compaction obtained by jetting.

Except as otherwise directed by the Engineer, after a period of not less than 30 days or more than 60 days, any settlement shall be filled with decomposed granite.

3.04 FIELD QUALITY CONTROL

- A. Contractor's Responsibility for Safety. The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the work. This requirement will apply continuously 24 hours a day every day until final acceptance of the work and shall not be limited to normal working hours.
- B. Warnings and Barricades. The Contractor shall provide and maintain barricades, guards, temporary bridges and walkways, watchmen, night lights and danger signals illuminated from sunset to sunrise, and all other necessary appliances

and safeguards to protect the work, life, property, the public, excavations, equipment, and materials. Barricades shall be of substantial construction and shall be painted such as to increase their visibility at night. Suitable warning signs shall be so placed and illuminated at night as to show in advance where construction, barricades, or detours exist. Guard rails shall be provided for bridges and walkways over or adjoining excavations, shafts, and other openings and locations where injury may occur.

- C. Compaction Tests. All compaction tests required by either the governing agency having jurisdiction over the right-of-way or by the District shall be performed by the District or its agent at District expense. However, in the event these tests prove the compaction to be unacceptable to either the governing agency or the District, all subsequent tests required by the governing agency or the District shall be performed at the Contractor's expense.

Tests will be scheduled within 24-hours of the Contractor's request for tests, at locations to be selected by the District and/or the governing agency. However, tests shall not be scheduled until a minimum 4-hours work is available for the testing laboratory, as determined by the Engineer. Results of these tests shall be available within 48-hours.

In-place soil densities shall be determined by the sand cone method of test in accordance with ASTM Standard D-1556-64, or by the nuclear method of test in accordance with ASTM Standard D-2922-071.

In accordance with provisions for guarantee of the work, the Contractor shall return at his expense to correct any backfill conditions subsequently found to be substandard by either failure or more extensive testing. The Contractor shall provide all labor and equipment necessary to prepare for all tests and to assist the soils engineer in taking the tests, as directed by the Engineer.

In unimproved areas the finish surfaces over pipelines shall be graded to drain surface water away from the center line of the actual trench and provide drainage away from all the structures. No ponding of surface water will be allowed within the construction right-of-way.

Contractor shall complete total trench restoration (original condition or better) within 1,320 feet of trench heading or within 10 working days of construction, whichever represents the least amount of time. Failure of the contractor to comply with the Engineer's cleanup orders may result in an order to suspend work until the condition is corrected. No additional compensation will be allowed as a result of such suspension.

END OF SECTION 02221