SECTION 312000 - EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Preparing subgrades for slabs-on-grade, walks, pavements, and landscaping.
   2. Drainage course for concrete slabs-on-grade.
   3. Excavating and backfilling for utility trenches.
   4. Excavating and backfilling for buildings and structures.
   5. Subbase course for concrete walks and pavements.
   6. Subbase and base courses for asphalt paving.

1.2 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.
   1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
   2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subgrade and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
   1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
   2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.

F. Fill: Soil materials used to raise existing grades.

G. Rock: Material, including boulders and granite, that cannot be removed by conventional earth moving or ripping equipment and require removal by techniques such as drilling
and blasting/splitting or jackhammering. Material is not rock when it is disintegrated, weathered, loose, or fractured to such an extent that it works and handles like soil.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Slurry: Can mean ABC, lime, or cementitious types. See CLSM for engineering term

J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below base course or topsoil materials.

K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.3 REFERENCES

A. Uniform Standard Specifications for Public Works Construction from the Maricopa Association of Governments (MAG Specs)

1.4 QUALITY CONTROL

A. Pre-excavation Conference: Conduct a conference at Project site including working foremen of all participating subcontractors and SRP PM.

1.5 PROJECT CONDITIONS

A. Utility Locator Service: Notify “Blue Stake” utility locator service at 602-236-1100 before beginning earth-moving operations.

B. Maintain underground and overhead utilities in continuous service unless prior approval has been obtained from the Engineer. Locate, safeguard, and maintain conflicting utilities shown on drawings and identified in field. Utility lines identified prior to excavation work, which are damaged by Contractor, shall be repaired at Contractor’s expense. Contractor shall identify conflicts by potholing for true depths and is responsible for relocation work needed to resolve conflicts.

C. Do not commence earth moving operations until plant-protection measures specified in Division 01 are in place.

D. Provide necessary support systems to meet all federal and state OSHA requirements for maintaining the stability of structures adjacent to excavations and excavation activities, and take necessary precautions to protect buildings, foundations and structures against damage. Contractor shall be liable for all damage.
PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: As specified in MAG Section 210.

C. Unsatisfactory Soils: Unsuitable materials include silt and clay soils with moisture content so significantly over optimum they cannot be compacted to the required maximum density. Sod, matted or decayed vegetation, expansive soil, and other deleterious material are also considered unsuitable backfill material and shall be removed from the jobsite.

D. Base Course: Aggregate Base Course as specified by MAG Section 702.

E. Engineered Fill: Fill as specified by the engineer on the drawings or within the specifications.

F. Bedding Course: Bedding shall be native or process material as required by the specifying utility.

2.2 ACCESSORIES

A. Detectable Underground Location Device: In accordance with ARS 40-360.22, all new and active underground facilities shall be installed with a detectible underground location device unless the facility is capable of being detected from above ground with an electronic locating device. Install acid and alkali resistant, warning tape manufactured for marking and identifying underground utilities. Install a minimum of 6 inches wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; or equivalent products that provide the same detection capability.

2.3 CONTROLLED LOW-STRENGTH MATERIAL (CLSM)

A. Acceptable CLSM mixtures as specified in MAG Section 728, latest revision.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. The Contractor shall not pass equipment over any pipe, drain, utility line, duct, or structure before they are adequately protected. Any damage to existing facilities and the costs associated with loss of utility use shall be at the Contractor's expense.

D. Use excavation shoring, bracing, sheeting, barricading, and plating necessary to perform work and protect excavation and personnel as required for safety and conformance to governing law, including OSHA Construction Standards, Subpart P, and Salt River Project Excavation Safety Resource Manual. Cost of protection systems shall be included in Contractor bid price.

3.2 GENERAL EXCAVATION

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.3 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

2. Cut and protect roots according to requirements in Division 01 Section "Temporary Tree and Plant Protection."

3.4 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under sidewalks, walkways, curbs/gutters, and pavements to indicated lines, cross sections, elevations, and subgrades.
3.5 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, tolerances, and elevations with allowances for minimum required bedding width, accommodation of compaction equipment and erection of forms.

B. Maximum continuous length and time of open trench shall not exceed the requirements of the governing municipality. A trench shall be considered open until backfilled to the top of subgrade on unsurfaced areas and the top of base course on pavements.

C. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: As indicated in Table 601-1 (from MAG Spec 601) below.

<table>
<thead>
<tr>
<th>Size Of Pipe (I.D.)</th>
<th>Maximum Width At Top Of Pipe Greater Than O.D. Of Barrel</th>
<th>Minimum Width At Springline Each Side of Pipe (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 18 inches</td>
<td>16 inches</td>
<td>6 inches</td>
</tr>
<tr>
<td>18 inches to 24 inches inclusive</td>
<td>19 inches</td>
<td>7 1/2 inches</td>
</tr>
<tr>
<td>27 inches to 39 inches inclusive</td>
<td>22 inches</td>
<td>9 inches</td>
</tr>
<tr>
<td>42 inches to 60 inches inclusive</td>
<td>1/2 O.D.</td>
<td>12 inches</td>
</tr>
<tr>
<td>Over 60 inches</td>
<td>36 inches</td>
<td>12 inches</td>
</tr>
</tbody>
</table>

D. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material, 4 inches deeper elsewhere, to allow for bedding course.

2. Remove excessive tooth marks or compact level.

E. Where soil incapable of supporting the utility is encountered, Contractor shall notify the Engineer and a determination will be made as to the depth of over-excavation and the type of engineered fill required.

F. Berm or otherwise protect trenches from surface drainage or runoff.

3.6 SUBGRADE INSPECTION

A. Any soft and unstable material shall be removed. The resulting areas and all sections, holes or depressions shall be bought to the required grade and cross-section.
B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer without additional compensation.

C. Clean excavation of trash and debris after completion of foundations, removal of forms, and other construction activities.

3.7 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. If approved by the Engineer, backfill unauthorized excavations using 1-½ sack cement CLSM.

1. Fill unauthorized excavations under other construction, pipe, or conduit using aggregate base course compacted to 95% density using ASTM D-6938 or ½ sack CSLM.

3.8 STORAGE OF SOIL MATERIALS

A. Stockpile borrowed soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations in accordance with OSHA regulations.

3.9 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated under footings to within 18 inches of bottom of footings with satisfactory soil or 1 ½ sack CLSM; fill final 18 inches with concrete to elevation of bottom of footings.

D. Trenches under Roadways: Unless otherwise specified by the controlling agency, place ½-sack CLSM as backfill in accordance with MAG Section 604.

E. Backfill material shall be uniformly within 2% of optimum moisture content prior to placement in the trench. Place backfill in level lifts simultaneously on both sides of the conduit, pipe, or structure unless otherwise specified. Backfill operations shall not cause disturbance of the in-place utility.

F. Backfill from bedding to a point approximately 6 inches above the top of the utility shall be placed in accordance with the specific utility requirements.
G. Place and compact approved backfill in uniform, level 8-inch thick maximum loose lifts to final subgrade elevation.

H. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

I. In projects outside of municipal rights-of-way and approved by the controlling utility, ½-sack cement CLSM per MAG Section 728 may be substituted for bedding and backfill for the convenience of the contractor at no additional cost to SRP.

3.10 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use on-site soils or fill approved by the Engineer.

C. All other conditions: Use soils as specified in MAG Section 210.

3.11 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 3 percent of optimum moisture content. Free water shall not appear on the surface during or after compaction. Fill at moisture contents greater than this value shall either be removed and replaced or scarified and air-dried to bring into conformance.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.

3.12 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in level lifts not more than 12 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers. Fill shall be placed so that, when compacted in a homogenous mass, it is formed free from lenses, pockets, streaks, or layers that differ substantially in texture and gradation from surrounding material. In no instance shall minimum compacted depth of a layer be less than maximum size of aggregate, plus one inch.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure. Place backfill uniformly against structures to prevent eccentric or excessive loading of structures.

C. Compact soil materials to at least the following percentages of maximum dry unit weight, at or within 3 percent of optimum moisture in accordance with ASTM D 698:

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1. Under structures, foundations, and building slabs, scarify the upper 6 inches of existing subgrade. Recompact subgrade and compact subsequent fill lifts to at least 100 percent of maximum dry density.

2. Under steps, sidewalks, walkways, curb/gutter, roadway shoulders, and pavements scarify and recompact the upper 6 inches of existing subgrade. Recompact subgrade and compact subsequent fill lifts to at least 95% of maximum dry density.

3. Unless specified by the controlling agency, utility trench bedding and backfill lifts shall be compacted to no less than the percentages of maximum dry density noted in Table 601-2 of MAG Section 601.

<table>
<thead>
<tr>
<th>Backfill Type</th>
<th>Location</th>
<th>From Surface To 2 feet Below Surface</th>
<th>From 2 feet Below Surface To 1 foot Above Top of Pipe</th>
<th>From 1 foot Above Top of Pipe to Bottom of Trench</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Under any existing or proposed pavement, curb, gutter, sidewalk, or such construction included in the contract, or when any part of the trench excavation is within 2-feet of the above.</td>
<td>100% for granular</td>
<td>95% for non-granular</td>
<td>90%</td>
</tr>
<tr>
<td>II</td>
<td>On any utility easement street, road or alley right-of-way outside limits of (I).</td>
<td>85%</td>
<td>85%</td>
<td>90%</td>
</tr>
<tr>
<td>III</td>
<td>Around any structures or exposed utilities.</td>
<td>95% in all cases</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

D. Do not cover lifts before compaction tests are performed. If lifts are covered prior to testing, excavate test pits for making density tests on lower portions of backfill at instruction of the Engineer. Refill and compact test pits in accordance with the specifications. Excavating, refilling, and compacting test pits shall be at Contractor’s expense.

E. Consolidation of backfill by flooding or jetting is permitted only with prior assessment by and written approval of the Engineer.

F. Mechanical compaction shall not be used within 6 inches of gas lines, electrical cable or plastic conduit.

G. If in the opinion of the Engineer, any portion of the surface of the backfill becomes so dry or glazed during construction that bond with the succeeding layer to be placed thereon cannot be obtained or should ruts and roadways develop on the backfill, such surface shall be scarified to a minimum depth of 6 inches, re-leveled, moisture conditioned, and re-compacted to the specified density just prior to placing of the succeeding layers at the Contractor’s expense.

H. All compaction equipment shall be of a type and size suitable to perform the required compaction and shall be subject to approval by the Engineer.
3.13 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. The compacted surface shall be graded to a straight grade between finished elevations shown in the plans or to the elevation of the existing ground at the edges of the area to be graded. Variations within the specified tolerance shall be compensating so that the average grade and cross-section specified are met.

B. Site Rough Grading: Unless otherwise shown on the plans, slope grades to direct water away from buildings and to prevent ponding. Rough subgrades shall not vary to required elevations in accordance with the following tolerances in any 10 feet from the specified grade and cross-section:
   1. Turf or Unpaved Areas: ±1 inch.
   2. Sidewalks, driveways, curb/gutter, walkways: ±1 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/4-inch when tested with a 10-foot straightedge. Under no circumstances shall overfill reduce minimum foundation thickness.

3.14 BASE COURSE UNDER SLABS, FOOTINGS, PAVEMENTS, SIDEWALKS AND CURB/GUTTER

A. Place base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place base course under pavements sidewalks and curbs/gutters as follows:
   1. Shape base course to required grades, lines and cross sections shown on the drawings.
   2. Place base course in loose lifts that do not exceed 12 inches in compacted thickness in layers of equal thickness, with no compacted layer less than 3 inches thick.
   3. Compact base course within 2% of optimum moisture content to not less than 100 percent of maximum dry unit weight according to ASTM D 698.
   4. Finished base course shall be no higher than the specified grade and cross section and no less than ¼-inch below specified grade and cross section. Variations within the above specified tolerance shall be compensating so that the average grade and cross-section specified are met.

3.15 FIELD QUALITY CONTROL

A. Testing Agency: SRP will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

B. Inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Engineer.

D. When subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

E. When any structural excavation is complete, notify SRP for an inspection. No materials shall be placed in the excavation prior to an inspection.

3.16 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
   1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.17 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION