

City of Scottsdale



2006

**SUPPLEMENT TO
MAG UNIFORM STANDARD SPECIFICATIONS
FOR PUBLIC WORKS CONSTRUCTION**

EFFECTIVE OCTOBER 19, 2006

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CITY OF SCOTTSDALE SUPPLEMENT TO MAG UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION

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Standard Detail Drawings and Specifications: are located on the City’s website at:
<http://www.ScottsdaleAZ.gov/Design/DetailDrawings/>

NOTE: * - Indicates new or revised specification sections for 2006 Supplement.

PART 100 - GENERAL CONDITIONS

**SECTION 101
ABBREVIATIONS AND DEFINITIONS**

101.1 ABBREVIATIONS: *Add the following abbreviation:*

COS = City of Scottsdale

101.2 DEFINITIONS AND TERMS:

Electrical Conductors: Primary conductors shall be those conductors designed with a rating capacity of 12.5 kV or less, single phase or three phase, or conduits designed or intended to carry those lines.

Service conductors shall be those electrical lines designed for direct service to commercial, industrial, residential, streetlight, or other direct users, or conduits designed or intended to carry those lines.

Delete the definition of "Engineer" and substitute the following:

Engineer: For all bond and Capital Improvement projects, the Engineer shall be the Municipal Services General Manager acting directly or through a duly authorized representative. For all Improvement District projects, the Engineer shall be the Municipal Services General Manager acting directly or through a duly authorized representative. For all Private development projects, the Engineer shall be the Development and Quality Compliance Director acting directly or through a duly authorized representative. For all references throughout Section 430 Landscape and Planting and Section 440 Sprinkler Irrigation System Installation, the Engineer shall be the COS Parks Department Landscape Specialist acting directly or through a duly authorized representative.

101.3 *Add the following paragraph:*

Also, in order to avoid cumbersome and confusing repetition of expressions in these specifications, it is provided that whenever MAG Uniform Standard Specifications (or Details) for Public Works Construction are referenced using, for example, such phrases as MAG Detail No. ____, MAG Standard Detail No. ____, MAG Standard Specification Section ____, MAG Section No. ____, etc., it shall be understood as if the phrase were followed by the words, "as amended by the COS Supplement, latest version." Similarly, it is provided that whenever a COS Supplement to MAG Uniform Standard Specifications (or Details) for Public Works Construction are referenced using, for example, such phrases as COS Detail No. ____, COS Supplemental Detail No. ____, COS Supplemental Specification Section ____, COS Section No. ____, etc., it shall be understood as if the phrase were followed by the words, "as it amends the MAG Uniform Standard Specifications (or Details) for Public Works Construction, latest version."

SECTION 102
BIDDING REQUIREMENTS AND CONDITIONS

102.4 Examination of Plans, Special Conditions and Site of Work:

At the end of the third paragraph, add the following:

If no information is given, i.e. soils report or logs of test bores, bidders shall make their own investigations and form their own estimates of the surface and sub-surface conditions of the project, especially in the vicinity of utilities.

**SECTION 103
AWARD AND EXECUTION OF CONTRACT**

103.6.1 General: *Add the following paragraph:*

(F) Prior to obtaining an encroachment permit, the Contractor must have on file with the City a Certificate of Insurance verifying the following coverages: Commercial General Liability coverage with combined limits of \$1,000,000.00. The City of Scottsdale must be named as additional insured party on the Contractor's automobile and general liability policies. Call the City of Scottsdale, Development Services for any changes in the figures listed above (telephone (480) 312-2500).

**SECTION 105
CONTROL OF WORK**

105.15(B) FINAL ACCEPTANCE: *Add the following paragraphs:*

Prior to partial or final acceptance of all public improvements, full size 4-mil (min.) reproducible photo mylar copies of the approved construction drawings of the subject improvements must be submitted to the City. In addition, 2 copies of any Traffic Signal Plans shall be submitted to the Traffic Signal Supervisor at 91919 E. San Salvador, Scottsdale, AZ 85258.

A certificate of occupancy for on-site improvements will not be issued to the developer until the Contractor is provided with a letter by the COS Field Engineering Manager that the work is complete and accepted by the City.

**SECTION 106
CONTROL OF MATERIALS**

106.5 STORAGE OF MATERIALS:

Delete the following sentences:

That portion of the right-of-way and easements not required for public travel may be used for storage purposes, when approved by the Engineer. Any additional storage area required must be provided by the Contractor.

Add the following paragraph:

Temporary construction storage sites must be provided by the Contractor. Sites that are to be located outside of the limits of construction as shown on the plans require the submittal of a site plan for separate permitting and approval prior to any site disturbance. Proof of permission for use will also be required for private parcels. Storage sites must also conform to the requirements of MAG Subsection 107.6.1, including COS supplemental requirements.

SECTION 107
LEGAL RELATIONS AND RESPONSIBILITY TO PUBLIC

Add the following subsections:

107.2.1 NPDES Permit:

(A) General requirements - The Contractor shall comply with the National Pollutant Discharge Elimination System (NPDES) Stormwater requirements for construction sites under the Environmental Protection Agency (EPA) General Permit for Arizona. Under provisions of that permit, the Contractor shall be designated as permittee and shall be responsible for providing the necessary labor and materials, and for taking the appropriate measures to assure compliance with the NPDES General Permit for Arizona as well as other Federal, State and local requirements pertaining to stormwater discharges. As the permittee, the contractor is responsible for completing, in a manner acceptable to the EPA, all documents required by this regulation including the following:

- (1) Stormwater Pollution Prevention Plan (SWPPP) for the project including certification form. The contractor will be required to update and revise the SWPPP as necessary throughout the construction of the project in order to assure compliance with EPA permit requirements. The completed SWPPP shall be kept on the project site at all times during construction of the project.
- (2) Notice of Intent (NOI) to be covered by NPDES General Permit for Arizona including certification of signature.
- (3) Notice of Termination (NOT) of coverage under NPDES General Permit for Arizona (upon project completion).

Copies of necessary forms, and guidance for preparing the SWPPP are available in the Drainage Design Manual for Maricopa County, Volume III EROSION CONTROL. The manual is available from the Flood Control District of Maricopa County, 2801 West Durango Road, Phoenix 85009, telephone (602) 506-1501.

(B) Submittals:

- (1) Preliminary copies of the NOI and SWPPP shall be submitted to the Engineer at the time of the preconstruction meeting. Any necessary revisions to the SWPPP shall be subject to review by the Engineer, prior to implementation.
- (2) The Contractor shall submit completed, signed NOI forms at least 48 hours prior to the initial start of construction on the project to EPA at the following address: EPA Stormwater Notice of Intent, P.O. Box 1215, Newington, VA 22122. One copy of the completed, signed NOI form shall be submitted to Arizona Department of Environmental Quality at the following address: Stormwater Coordinator, ADEQ, P.O. Box 600, Phoenix, Arizona 85001-0600.
- (3) Failure by the contractor (or any of its appropriate subcontractors) to submit the NOI forms within the required time frame shall result in delay of the start of construction. The contractor shall submit a completed copy of the NOI prior to Notice to Proceed. A copy of the completed NOI shall be posted on the construction and a copy of the SWPPP shall be kept on the construction site.

(C) Contractor's Responsibilities:

(1) It is the Contractor's responsibility to perform inspection of all stormwater pollution control devices on the project on a monthly basis and following each rainfall of 0.50 inches or more at the project site and as required under the NPDES General permit for Arizona. The contractor shall prepare reports on these inspections and retain these reports for a period of three years following project completion as required under the NPDES General Permit for Arizona. Inspection reports shall be submitted monthly to the contracting agency along with payment requests. The contractor shall maintain all stormwater pollution control devices on the project in proper working order, including cleaning and/or repair during the duration of the project.

(2) No condition of either the NPDES General Permit for Arizona or the SWPPP shall release the contractor from any responsibilities or requirements under other environmental statutes and regulations.

(3) Upon total project completion, acceptance, and de-mobilization, the contractor shall submit its completed, signed NOT form to the EPA with copies to the same agencies who received copies of the NOI, thereby terminating all NPDES permit coverage for the project.

(D) Payment: There shall be no separate payment made to the Contractor for all material, labor, and other incidental costs relating to the provision, installation, and maintenance of items relating to this permit during project construction. Such incidental costs shall include contractor costs in order to assure proper operation of the pollution-control devices installed including all maintenance, cleaning, and disposal costs associated with clean-up and repair following storm events or other runoff or releases on the project.

107.2.2 Air Quality Permit:

(A) General Requirements: The Contractor shall comply with the Maricopa County Air Pollution Control Regulations, as revised July 6, 1993, governing construction activities. Under provisions of this regulation, the Contractor shall be designated as permittee and shall be responsible for providing the necessary labor and materials, and for taking the appropriate measures, to assure compliance with the regulations. As the permittee, the Contractor is responsible for completing all documentation required by the regulation, including the following:

(1) Application for Earth Moving Equipment Permits and Permits to Operate required by Rule 200 and Rule 310 of the above regulations.

(2) Control Plan to prevent or minimize fugitive dust will be submitted with the completed Application for Permit.

Copies of permit applications and sample control plan formats may be obtained from the Maricopa County Environmental Management and Transportation Agency, Division of Air Pollution Control, 2406 South 24th Street, Suite 214, Phoenix, AZ 85034; telephone: 602-506-6700.

(B) Information Required for Inclusion in a Control Plan:

(1) Name(s), address(es) and phone number(s) of person(s) responsible for the preparation and implementation of the Control Plan and responsible for the dust generating operations.

(2) A plot plan of the site which describes:

- (a) The total area of land surface to be disturbed and the total area of the entire project site, in acres;
- (b) The operation(s) and activities to be carried out on the site;
- (c) All actual and potential sources of fugitive dust emissions on the site;
- (d) Delivery, transport and storage areas for the site, including types of materials stored and size of piles.

(3) A description of:

(a) Reasonably available control measures or combination thereof to be applied during all periods of dust generating operations to each of the fugitive dust sources described on the plot plan. For each source identified at least one control measure must be implemented;

(b) Dust suppressants to be applied, including product specifications or label instructions for approved usage; the method, frequency and intensity of application; the type, number and capacity of application equipment; information on environmental impacts and approvals or certifications related to appropriate and safe use for ground applications;

(c) The specific surface treatment(s) and/or reasonably available control measures utilized to control material track-out and sedimentation where unpaved and/or access points join paved surfaces.

(d) For each fugitive dust source at least one auxiliary reasonably available control measure designated as a contingency measure shall be described in the original Control Plan. Should the original reasonable available control measure in the Control Plan prove ineffective, immediate, successful and effective implementation of the contingency measure shall obviate the requirement of submitting a revised Control Plan.

(C) Haul Trucks: The following requirements shall apply to the use and operation of any haul truck:

(1) The cargo compartment of a haul truck shall be constructed and maintained so that no spillage or loss of bulk materials can occur from holes or other openings in the cargo compartment.

(2) Any haul truck carrying bulk materials shall be properly loaded so that the freeboard is not less than three inches and be effectively covered with a tarp or other suitable enclosure in such a manner so as to prevent or minimize fugitive dust.

(3) Any haul truck shall be cleaned or kept covered once emptied and/or between cargoes when the residual particulate matter remaining in the cargo space is capable of becoming fugitive dust.

(D) Submittals:

(1) Preliminary copies of the Contractor's permit application and control plan shall be submitted to the Engineer at the time of the pre-construction conference. Any necessary revisions recommended by the Engineer will be made prior to submission to the County.

(2) The Contractor shall submit the completed application and control plan to the County, at the above address, at least 48 hours prior to the projected start of construction.

(3) Failure of the Contractor to obtain a signed Earth Moving Air Quality Permit from the County may result in delay of the start of construction. The Contractor shall submit a signed copy of the permit, with the control plan, to the Contract Administrator and maintain a copy in a conspicuous location at the construction site.

(E) Contractor's Responsibilities:

(1) It is the Contractor's responsibility to apply Reasonably Available Control Measures (RACM) to all phases of construction activities to prevent or minimize the generation, emission, entrainment, suspension and/or airborne transport of fugitive dust. Typical RACM are identified in the Regulations, which may be obtained at the above address.

(2) If the Contractor or Contract Administrator determines during construction activities that the initial control plan is inadequate, revisions to the plan will be made by the Contractor and submitted to the Engineer for approval.

(F) Payment: There shall be no separate payment made to the Contractor for material, labor, and other incidental costs relating to the provision, installation, and maintenance of items relating to this permit during project construction.

107.2.3 Marshalling Yard Permit:

The Contractor is required to obtain a permit from the City when using vacant property to park and service equipment and store material for use on the Contract Agency construction contracts. This permit will conform to the requirements of MAG Subsection 107.6.1, including COS supplemental requirements.

Modify the following subsections:

107.6.1 Contractor's Marshalling Yard: *Add the following paragraphs after the first paragraph (added text is highlighted):*

...when using vacant property to park and service equipment and store material for use on the Contracting Agency construction contracts.

The Contractor shall not store equipment, personal vehicles or materials within the right-of-way.

The Contractor shall obtain a permit from the City for marshalling areas they propose to use. Minimum requirements include the following:

Add the following paragraphs after paragraph (H):

(I) The Contractor shall notify adjacent property owners/residents of the proposed use.

(J) An appropriate distance from adjacent property will be set by the City on a case-by-case basis based on the size and type of equipment to be used on the project.

(K) A sight or sound barrier may be required if deemed necessary by the City.

107.9 PROTECTION AND RESTORATION OF PROPERTY AND LANDSCAPE: *Add the following paragraphs:*

All areas that are shown on the plans as Natural Area Open Space (NAOS) shall be staked and flagged prior to any grading activity. Inadvertently disturbed areas shall be revegetated with indigenous material in natural densities.

Native plants protected by City of Scottsdale Zoning Ordinance Sec. 7.500 shall not be disturbed without proper permit and approval. Protected native plants within the construction limits shall not be destroyed unless tagged with blue plastic tape in accordance with Chapter 46, Article V of the Scottsdale Revised Code.

The Contractor shall submit a revegetation and irrigation plan to the City Inspector within 14 days of the disturbance. Following City approval of the revegetation and irrigation plan, the Contractor shall repair the disturbed area within 14 days unless a time extension is granted by the Engineer.

107.11 CONTRACTOR'S RESPONSIBILITY FOR UTILITY PROPERTY AND SERVICES: *Add the following paragraphs:*

Existing in-service water valves, sewer manholes, or sewer clean-outs that are damaged during construction or are inaccessible due to construction shall be repaired or made accessible within seven (7) working days. If the deficiencies are not corrected within the prescribed time period, the necessary repairs will be affected by the City of Scottsdale at the expense of the Contractor.

The Contractor shall be responsible for the immediate repair and reporting of any damage to any traffic signal equipment. This shall include, but shall not be limited to, such items as: underground conduit, detectors, detector lead-in wiring, signal heads, signal poles, mast arms, cables, controller, and other signal-related equipment. Wire splicing will not be permitted. Modification of traffic signals for construction shall require advance design and approval prior to the start of construction. All materials and installations shall conform to the latest Arizona Department of Transportation standard drawings and specifications for traffic signals, except as approved by the COS Traffic Engineering Director.

PART 300 - STREETS AND RELATED WORK

**SECTION 321
ASPHALT CONCRETE PAVEMENT**

321.5.1 Base Preparation: *Add the following paragraph:*

All street sections without curb and gutter are required to have a thickened edge per MAG Standard Detail No. 201 - Type A.

321.5.4 Asphalt Base and Surface Course: *Modify the sixth paragraph above Table 321-1 to read as follows (Added text is highlighted.):*

The completed surfacing shall be thoroughly compacted, smooth, and true to grade and cross-section, **within the tolerances specified herein**, and free from ruts, humps, depressions, or irregularities. An acceptable surface shall not vary more than 1/4-inch from the lower edge of 12-foot straightedge when the straightedge is placed **parallel or perpendicular** to the centerline of the roadway. The straightedge will be furnished by the Contractor and shall be acceptable to the Engineer. **In addition to the smoothness requirements specified above, asphalt concrete pavement shall be true to the grades shown or indicated on the plans and shall not vary more than 1/4-inch from the plan elevations. Finish pavement grades adjacent to curbs shall be within 1/4-inch of the design elevation but in no case below the lip of the gutter.**

321.5.5 Preservative Seal: *Add the following paragraph:*

Preservative seal on streets classified as residential and local collector shall be in accordance with MAG Section 718, Type D (polymer modified type B). Preservative seal shall be applied no earlier than 48 hours after completion of surface course paving, and no later than the end of the warranty period.

**SECTION 336
PAVEMENT MATCHING AND SURFACE REPLACEMENT**

336.2.4 Permanent Pavement Replacement: *Add the following paragraph:*

The acceptable surface profile from the existing surface across a pavement replacement shall not vary more than ¼-inch from the lower edge of a 12-foot straightedge when the straightedge is placed parallel or perpendicular to the centerline of the roadway. When the width of the pavement replacement is greater than six (6) feet, compliance with the specification shall be measured by placing the straightedge a minimum of 4-feet overlapping the existing pavement.

336.3 TYPES AND LOCATIONS OF PAVEMENT AND SURFACING REPLACEMENT

Add the following paragraph:

The Contractor will be responsible to replace, at his own cost, any and all damaged pavement outside the pay limits, due to his construction activities on the project. This includes, but is not limited to, the replacement of newly cracked pavement, the replacement of existing cracked pavement where the cracks have been widened, the replacement of any chipped or missing pieces of pavement, and the replacement of any deformed pavement. The pavement will be sawcut at right angles to the roadway, to encompass the replacement areas.

**SECTION 340
CONCRETE CURB, GUTTER, SIDEWALK, SIDEWALK RAMPS, DRIVEWAY
AND ALLEY ENTRANCE**

340.1 DESCRIPTION: *Add the following sentence:*

All driveways, alley entrances and sidewalk ramps constructed in the City of Scottsdale shall be a minimum of 8 inches thick.

All sidewalks constructed adjacent to roll, ribbon, mountable curb or other curb which may be easily driven over, shall be a minimum of 5 inches thick.

All curb and sidewalk at curb returns shall be monolithically poured.

MAG Standard Detail 206, Concrete Scupper, shall be the basis of scupper construction unless prior approval is obtained from City staff.

340.3 CONSTRUCTION METHODS: *Is modified as follows:*

Delete the last sentence of paragraph 10 and insert the following:

Joints shall be constructed at all radius points, driveways, alley entrances, and at adjoining structures with a maximum interval of 50 feet between joints, and shall provide for complete separation of adjoining structures.

Add the following paragraph between paragraphs 16 and 17 (Added text is highlighted.):

In the event water is found ponded in the gutter to a depth greater than 1/2-inch, or on the adjacent asphalt pavement, the defect or defects shall be corrected in a manner acceptable to the Engineer without additional cost to the Contracting Agency.

In addition to the straightedge requirements specified herein, all finish concrete elevations shall not deviate from the elevations shown on the plans, or indicated by typical sections or standard details referenced within the construction documents, by more than 1/4 inch as determined by the Engineer. Areas between elevations shown on the plans shall be straight graded or smoothly transitioned through a vertical curve in a manner approved by the Engineer or as otherwise indicated on the construction documents.

Sidewalk panels, all gutters, curbs, and aprons with cracks shall be replaced by the Contractor.

Any section of the work deficient in depth or not conforming to the plans or specifications shall be removed and replaced by the Contractor at no additional cost to the Contracting Agency.

**SECTION 342
DECORATIVE PAVEMENT
CONCRETE PAVING STONE OR BRICK**

342.1 GENERAL:

Delete the word "crosswalks" after pavement and add the sentence number two.

The Contractor shall furnish all the necessary labor, material, tools and equipment to complete the proper installation of the concrete pavers used in decorative pavement, medians or as otherwise noted in the Contract Documents. Pavers in cross walks shall not be installed. This includes furnishing a 10-foot straightedge to accomplish the level test specified for the finished decorative pavement.

The decorative pavement shall be true as to line and grade and installed to coincide and align with the adjacent work elevation. All edges shall be retained to secure the perimeter and sand laying course.

The Contractor shall construct a 5 feet x 5 feet square minimum sample area which will be inspected and approved by the Engineer prior to any other decorative pavement placement.

342.2 MATERIALS:

342.2.1 Aggregate Base Course: The ABC shall be aggregate base as per MAG Table 702.

342.2.2 Concrete Header and Base Slab: The header and base slab shall be Class A concrete as per MAG Section 725.

342.2.3 Expansion Joint: Expansion joint filler shall be premolded and comply with MAG Section 729 and ASTM D-1751.

342.2.4 Sand Laying Course: Shall be a concrete sand conforming to ASTM C-33 and meeting the following gradation.

<u>Sieve Size</u>	<u>3/8 inch</u>	<u>No. 4</u>	<u>No. 8</u>	<u>No. 100</u>	<u>No. 200</u>
% passing	100	93-100	61-100	1-12	0-7

342.2.5 Concrete Pavers: The concrete paver thickness shall be 3-1/8 inches (80 mm). Pavers shall be of an interlocking design conforming to ASTM C-936-82. Pavers shall be sound and free of defects that would interfere with the proper placing of the unit or impair the strength or permanence of the construction. The pavers and materials used in their manufacture shall conform to the following:

(A) Compressive strength: Pavers shall have a minimum compressive strength of 8000 psi in accordance with ASTM C-140.

(B) Absorption: The average absorption shall not be greater than 5 percent, with no individual unit absorption greater than 7 percent.

(C) Cement - ASTM C-150 (Portland Cement).

(D) **Aggregates:** ASTM C-33 (washed, graded sand and rock, no expanded shale or lightweight aggregates).

(E) **Other Constituents:** Coloring pigments shall be applied integrally to the concrete. Air entraining admixtures, coloring pigments, integral water repellents, and finely ground silica shall be previously established as suitable for use in concrete and either shall conform to ASTM standards where applicable, or shall be shown by test or experience not to be detrimental to the concrete.

(F) The size, shape, design and color shall be as noted in the Contract Documents.

(G) The Contractor shall submit two samples of the whole paving stone to the Engineer for approval prior to any work.

(H) Length or width of units shall not differ by more than $\pm 1/6$ inch (± 4.2 mm) from approved samples. Heights of units shall not differ by more than $\pm 1/8$ inch (± 3.2 mm) from the specified standard dimension.

342.2.6 Structural Metals: Steel protection angles and bolts shall conform to the requirements of MAG Section 770.

342.2.7 Reinforcing: Welded wire fabric used as reinforcement in concrete shall conform to the requirements of MAG Subsection 727.3.

342.2.8 Paint: Paint color shall be Number 9 (Light Grey) and shall conform to the requirements of MAG Section 790.

342.3 CONSTRUCTION PROCEDURES:

342.3.1 Subgrade: The subgrade shall be constructed true to grades and lines shown on the plans and compacted to a relative density of 95 percent as specified in MAG Section 301.

342.3.2 Aggregate Base Course: The aggregate base course shall be constructed true to grades and lines shown on the plans and compacted as specified in MAG Section 310. The surface of the ABC shall be tested with the 10 foot straightedge and shall not vary more than $+1/8$ inch in 10 feet.

342.3.3 Concrete Header and Base Slab: The concrete header and base slab shall be of Class A concrete and reinforced with 6 x 6 inch wire mesh fabric (6 inches x 6 inches 1.4 x 1.4 WWF designation). Steel Protection Angles, L 3/8 inch x 3 inches x 3 inches shall be cast-in-place and set to final line and grade as indicated on the plans and shall not cross expansion or contraction joints.

Forms shall be thoroughly cleaned each time they are used, and shall be coated with a light oil, or other releasing agent of a type which will not discolor the concrete.

The concrete shall be thoroughly spaded away from the forms so that there will be no rock pockets next to the forms. The concrete may be compacted by mechanical vibrators approved by the Engineer. Tamping or vibrating shall continue until the mortar flushes to the surface, and the coarse aggregate is below the concrete surface.

All edges shall be shaped with a suitable tool so formed as to round the edges to a radius as indicated on the standard details.

The concrete header face form shall not be removed before the concrete has taken the initial set and has sufficient strength to carry its own weight. The concrete header outer form shall not be removed until the concrete has hardened sufficiently to prevent any damage to the concrete. Any portion of concrete damaged while stripping forms shall be repaired or if the damage is severe, replaced at no additional cost to the Contracting Agency. The face and top of the concrete header shall be tested with a 10-foot straightedge or curve template, longitudinally along the surface. Any deviation in excess of 1/4 inch shall be corrected at no additional cost to the Contracting Agency.

Any section of the work deficient in depth or not conforming to the plans or specifications shall be removed and replaced by the Contractor at no additional cost to the Contracting Agency.

Finishing and curing of the concrete shall be done in the manner specified in MAG Section 505.

342.3.4 Expansion and Construction Joints: Premolded 1/2" joint filler strips, ASTM D-1751 per MAG Sec. 729, shall be placed 1/2" below the surface of the concrete, the full width of the expansion joint. The remainder of all joints shall be filled to the surface of the concrete with a premium-grade, high-performance, moisture-cured, single-component, polyurethane-based, non-sag elastomeric sealant, ASTM C-920, Type S, Grade NS, Class 25; Sikaflex-1a or equal.

Joints shall be constructed in a straight line and vertical plane perpendicular to the longitudinal line of the concrete header, except in cases of curved alignment when they will be constructed along the radial lines of the header. They shall be constructed to the full depth and width of the concrete header and base slab. Pavers shall be placed continuously over the expansion joints.

342.3.5 Contraction Joints: Contraction joints shall be constructed in a straight line and vertical plane perpendicular to the longitudinal line of the concrete header, except in cases of curved alignment when they will be constructed along the radial lines of the header. They shall be constructed to a depth of 1 inch with rounded edges and placed at 10 foot intervals. Contraction Joints shall be filled to the surface of the surrounding concrete with elastomeric sealant specified in 342.3.4.

342.3.6 Painting: Protection Angles shall be painted on all surfaces not in contact with concrete with one prime coat, a second coat and a finish coat. All painting shall be done after steel is fabricated and prior to installation.

342.3.7 Sand Laying Course: The maximum thickness of the sand course shall be 1 inch. Screeding boards shall be used to ensure a uniform thickness. The sand shall not be compacted, walked on or wet down. The sand course shall be treated with a pre-emergent herbicide, such as Surflan, or equal. The application of the herbicide shall be made not earlier than 4 hours prior to actual placement of the decorative pavement.

342.3.8 Concrete Pavers: The concrete pavers shall be clean and free of foreign materials before installation. Paving work shall be plumb, level and true to line and grade and shall be installed to properly coincide and align with adjacent work and elevations. All edges must be retained to secure the perimeter

pavers and the sand laying course. The pavers shall be laid in such a manner that the desired pattern is maintained and joints between the pavers are as tight as possible.

The Contractor shall lay the pavers starting from the longest straight line and from a true 90 degree corner. The pavers shall be installed hand-tight and level on the undisturbed sand course in a manner that eliminates gaps between the stones and the edge retention header. String lines shall be used to hold all pattern lines true. The gaps at the edge of the paver surface shall be filled with pavers cut to fit. Cutting shall be accomplished to leave a clean edge to the traffic surface using a masonry saw cut.

After the pavers are in place, they shall be vibrated into the sand laying course using a vibrator capable of 3,000 to 5,000 pounds compaction force. This will require two passes at 90 degrees to each other. After vibration, approximately 1/4-inch of clean masonry sand containing at least 30 percent of 1/8-inch particles shall be placed over the paver surface, allowed to dry, and vibrated into the joints with additional vibrator passes and brushing so as to completely fill joints. Excess sand shall be swept from the surface.

The finished paver surface shall be tested longitudinally and transverse to the concrete header or curb with a 10-foot straightedge along the surface. Any deviation in excess of 1/8 inch shall be corrected at no additional cost to the Contracting Agency.

Any broken or damaged pavers shall be removed and replaced. Replacement pavers shall be tamped into place and the joints filled with masonry sand as specified herein. The completed installation shall be cleaned of all debris, surplus material and equipment.

342.4 MEASUREMENT AND PAYMENT:

Measurement will be by the square foot. Payment will be made at the unit bid price per square foot. This payment shall be full compensation for all labor, materials, tools and equipment required to complete the work for the concrete pavers, headers and base materials described herein and indicated in the standard details and contract documents.

**SECTION 343
 EXPOSED AGGREGATE PAVING & ASPHALT PRINT PAVING**

Add the following paragraphs to this section:

343.5 ASPHALT PRINT PAVING GENERAL

The Contractor shall furnish all the necessary labor, material, tools, and equipment to complete the proper installation of the asphalt print paving used in decorative pavement, cross-walks, medians or as otherwise noted in the Contract Documents. This includes furnishing a 10-foot straight edge to accomplish the level test specified for the finished decorative pavement.

343.6 MATERIALS:

343.6.1 Aggregate Base Course: The ABC shall be aggregate base as per MAG Table 702.

343.6.2 Asphalt Concrete Pavement: Asphalt concrete pavements shall be MAG 321 and as specified in the Contract Documents.

343.6.3 StreetBond Traffic Formula or approved alternate

Characteristics	Test specification	Standard
Solids by volume (%)	ASTM D5201	53±3%
Solids by Weight (%)	ASTM D1351	75.5±2%
Density (lbs/gal)	ASTM D1475	14.6±0.2 (1.75 gr/l)
Flash Point	ASTM D3278	>200°F (93°C)
Percent Pigment (by weight Including cement)	ASTM D3723	62±2%
Sheen (85°F)	ASTM D523	<3@85°F

343.6.4 StreetBond Sealer or approved alternate

Characteristics	Test specification	Standard
Solids by volume (%)	ASTM D5201	24±3%
Solids by Weight (%)	ASTM D1353	27±2%
Density (lbs/gal)	ASTM D1475	8.59
Specific Gravity	ASTM D1475	1.03
Flash Point	ASTM D3278	>200°F (93°C)
VOC Coating	ASTM D3960	>200
Sheen (85°F)	ASTM D523	>75@85°F

343.6.4 StreetBond Surfacing System or approved alternate

Characteristics	Test specification	Standard
Tensile Strength	ASTM D412	>650 psi
Flexibility Mandrel (High)	ASTM D1737	Pass 1" @ 70°F
Flexible Mandrel (Low)	ASTM D1737	Pass 2" @ 70°F
Dry Time (to recoat)	ASTM D711	20 mins-4 hours
Dry Time (for Traffic)(75°F/30%RH)	NA	≅80% Strength @6-8 hrs
Taber Abrasion (H-10)	ASTM D4060	<0.18 gr/1000 cycles
Adhesion (PLI) to an Asphalt	ASTM D4650	Cohesive failure of asphalt

Substrate		prior to adhesive failure
QUVAE	ASTM G53	300 hours 2.35 CIE units
Hydrophobicity (3 Days)	ASTM D570	<12%wt. Gain
Shore Hardness	ASTM D 2240	80 D
Temperature Limits for Service	Dry, cured material	-30 ⁰ F to 160 ⁰ F
Surface Build	NA	20-25 mils (2 applications)
Color		Terracotta or as per plans

343.7 CONSTRUCTION PROCEDURES

343.7.1 Surface Imprinting: The contractor shall follow procedures detailed in the latest revision of StreetPrint Application Procedures as issued or as provided by the manufacturer of the approved alternate. The pattern shall be as shown on the Plans or as approved by the Engineer. Patterning shall begin once the asphalt has reached its final density and while there is still sufficient heat in the asphalt to permit imprinting. Patterning shall be achieved using steel rollers and/or vibratory plates and shall be of consistent depth. Maximum stamping depth shall be 1/2-inch.

343.7.2 StreetBond Surfacing Systems or approved alternate: Two applications of the StreetBond Traffic Formula in the color as indicated on the plans or approved by the Engineer shall be used. StreetBond Sealer or approved alternate shall be applied over the StreetBond Traffic Formula or approved alternate.

343.7.2 Application of Asphalt Printing Paving: The StreetBond Traffic Formula and StreetBond Sealer shall not be applied in temperatures below 45 ⁰F and rising, or when precipitation can be expected within 24 hours. Installation shall be in accordance with the latest revision of the manufacturers procedures. The StreetBond Traffic Formula product shall be spray applied and broomed using a broom or brushes to cut in small areas where required. Once the StreetBond Traffic Formula products are fully dried, StreetBond Sealer shall be applied as a curing membrane. StreetBond Sealer shall be tinted using the resin from the StreetBond Traffic Formula product, spray applied and broomed into the surface. Care shall be taken to ensure that the entire surface is covered, including the imprinted surfaces. Sufficient masking shall be used to ensure that the surfacing products are applied only where specified. Maximum reheating of asphalt shall be 200 degrees F.

343.8 MEASUREMENT AND PAYMENT: This item will be measured and paid for at the contract price bid per square foot of Asphalt Printing Pavement. This bid price shall include all associated items of work involved in the asphalt printing pavement process.

SECTION 345
ADJUSTING FRAMES, COVERS, VALVE BOXES
AND WATER METER BOXES

345.2 ADJUSTING FRAMES: *Add the following paragraph:*

Manholes outside of vehicle travel lanes shall be adjusted to 2-inches above finished grade. All manholes shall have a concrete collar around the ring and cover per COS Standard Detail No. 2270.

Catch basin access frame and covers shall be round per MAG 536-2.

345.3 ADJUSTING VALVE BOXES: *Add the following paragraph:*

All valve boxes shall be adjusted to finished grade upon completion of paving or related improvements in accordance with the following requirements:

(A) When a valve box is new, adjusted, or replaced, it shall be an adjustable cast iron type with pentagonally-bolted lid, MAG Standard Detail No. 391-1, Type "C". In unpaved roads, the MAG Standard Detail No. 391-1, Type "C" installation shall include the concrete collar as shown in COS Standard Detail No. 2270, with an approved debris cap.

(B) Existing type "A" or type "B" valve boxes located in areas which will remain unpaved when construction is completed may remain, but they must be adjusted to finished grade when grading is completed with a concrete collar installed as shown in COS Standard Detail 2270.

(C) Existing type "A" valve boxes located in existing paved areas must be removed and replaced with type "C" boxes.

(D) Existing type "B" valve boxes located in existing paved areas must be removed and replaced with type "C" boxes.

(E) Existing type "A" or type "B" valve boxes in unpaved areas which will be paved when construction is completed must be removed and replaced by type "C" valve boxes.

SECTION 350
REMOVAL OF EXISTING IMPROVEMENTS

350.2 CONSTRUCTION METHODS: *Add the following paragraphs:*

When roadway construction requires the removal or the revision of existing pavement striping or marking, it shall be the Contractor's responsibility to remove existing pavement striping or marking using sand, high pressure water, or reclaimed shot blasting. After removal, all area affected by the removal shall be resealed with a quick setting asphalt emulsion. Obliteration of pavement striping or marking will be allowed only when Type II slurry seal per MAG Section 332 is indicated in the contract documents or with written approval of the COS Traffic Engineering Division.

350.4 PAYMENT: *Add the following paragraphs:*

Removal or obliteration of pavement striping and marking shall be measured and paid as described herein. Striping will be in linear feet of equivalent four (4) inch wide stripes, excluding lengths of skips. Pavement markings and markers will be measured each, as designated in the bid schedule.

**SECTION 360
TELECOMMUNICATIONS AND UTILITIES INSTALLATION**

360.1 DESCRIPTION: *Add the following paragraph:*

All telecommunications facilities and non-municipal utilities placed within public rights-of-way shall bear an identification plaque bearing the company name, address and phone number of the facility owner. The plaque shall be stamped or engraved with letters 1/8" minimum in height. The identification plaque shall be aluminum, stainless steel or other non-corrosive metal. The plaque shall be permanently attached with stainless steel screws or rivets. The plaque shall be visibly placed on the top or as near as practicable to the top of the facility (cabinet, junction box, etc.)

SAMPLE:

FOR QUESTIONS REGARDING THIS FACILITY
PLEASE CONTACT:

NETLINK
3930 E. WATKINS RD, SUITE 200
PHOENIX, AZ 85034

PART 400 - RIGHT OF WAY AND TRAFFIC CONTROL

**SECTION 401
TRAFFIC CONTROL**

401.5(A) ON BOND ISSUE AND BUDGET PROJECTS: *Delete in its entirety.*

401.5(B) ON IMPROVEMENT DISTRICT PROJECTS: *Delete the subsection designation "(B) On Improvement District Projects" and delete the first paragraph which reads: "All existing traffic lanes on major streets ... unless otherwise specified in the special provisions."*

Delete the seventh paragraph which reads: "The Traffic Engineering Department will reset all STOP, YIELD, and street name signs to permanent locations."

Combine the remaining paragraphs of 401.5(B) into the main body of 401.5 and add the following paragraphs:

No work requiring the closure of arterial or collector traffic lanes shall be done between the hours of 7:00 A.M. to 9:00 A.M. and 4:00 P.M. to 6:00 P.M.. The roadway must be completely unobstructed during these hours. At other times, a minimum of one lane of traffic for each direction of travel shall remain open. All signs must be turned or removed from driver's sight when work is not being accomplished within the roadway. Any exceptions to this must be approved in advance, in writing, by the COS Transportation General Manager or his Designee.

Traffic control shall conform to the latest City of Phoenix Traffic Barricade Manual and/or as directed by the COS Traffic Engineering Division, COS Inspection Services, or MUTCD Manual.

A barricading plan shall be submitted to COS Inspection Services a minimum of 72 hours prior to any proposed partial or complete street closure. Work shall not commence on the portion of the project requiring street barricading until approval has been obtained in writing from both COS Inspection Services and Traffic Engineering Division.

Arrow panels are required during all barricade setups on roadways with posted speeds of 35mph or greater.

Uniformed off-duty police officers require a minimum 72 hours notice prior to commencement of their service.

Add the following section:

**SECTION 402
PAVEMENT MARKINGS AND SIGNING**

402.1 GENERAL:

The work under this item will provide the final striping and marking of all pavements and the installation of traffic control signs as described herein in accordance with COS Standard Details and as shown on the plans.

Any striping other than the replacement of pre-existing striping shall be done in accordance with a plan prepared by a registered Engineer and approved by the COS Traffic Engineering Division.

All construction shall conform to Arizona Department of Transportation standard drawings and specifications unless otherwise specified in COS Standard Details, the "Manual On Uniform Traffic Control Devices", latest edition, or as otherwise specified in the contract documents.

402.2 PAVEMENT MARKINGS:

Permanent lane striping shall be 90 mil. extruded thermoplastic material, conforming to all requirements of ADOT Standard Specifications Section 704, latest edition. Crosswalks and stop lines shall be 90 mil extruded hot thermoplastic material conforming to ADOT Standard Specifications Section 704.

The actual width of the stripe shall be:

<u>Plan Width</u>	<u>Actual Width</u>
4 inches	4 to 4.5 inches
6 inches	6 to 6.5 inches
8 inches	8 to 9 inches
over 8 inches	+/- 1 inch

Pavement symbols, arrows and legends shall be preformed markings, Type I (Permanent) pavement tape conforming to all requirements of ADOT Standard Specifications Section 705, latest edition, unless noted otherwise on the plans. Tape shall meet or exceed the specifications of 3M 380-IES series and shall in addition meet or exceed applicable ADOT Specifications.

Painting shall be provided on all median noses and at temporary pavement marking locations where indicated on the plans and standard details. Reflectorized paint materials shall be white or yellow as noted and shall meet ADOT Standard Specifications Section 708. Glass beads shall be applied to all painted surfaces.

Raised pavement markers shall conform to requirements of ADOT Standard Specifications Section 706, latest edition.

Obliteration of any existing pavement markings required for new work shall be accomplished per COS Supplemental Specification Subsection 350.2.

402.2.1 Measurement And Payment: Pavement striping and markings shall be measured and paid as described in the ADOT specifications. Striping will be in linear feet of equivalent four (4) inch wide stripes, excluding lengths of skips. Pavement markings and markers will be measured each, as designated in the bid schedule. Costs for temporary markings and signs are not included in this item but will be included in the bid price for traffic control.

402.3 SIGNING:

All traffic signs shown on the plans to be installed after the roadway improvements are completed shall be mounted on square tubular sign posts as specified herein when existing street light pole cannot be used, due to spacing or lack thereof.

Sign mounting heights and offset from edge of roadway shall per the MUTCD Manual. Sign blanks shall be 0.080 gauge anodized aluminum. Unless noted otherwise herein, sign faces shall be ASTM Type II retroreflective sheeting, sometimes referred to as "super engineering grade". Background and legends shall both meet Federal Highway Administration Standards.

All existing signs shall be inventoried prior to roadway work. Signs which are not reused shall remain the property of the City and will be carefully removed and delivered to the COS Sign Shop at 9191 E. San Salvador Drive. The Contractor shall remove any existing concrete bases using care not to damage the post. Any signs that will be used at project completion shall be stored safely and protected against damage at the Contractor's job site and shall be leveled, squared and set in ground per COS anchoring specifications and per MUTCD height and offset specifications.

402.3.1 Steel Square Tubular Sign Post Assembly: The sign post assembly shall consist of the post (1-3/4 inch x 1-3/4 inch square tubing, length per sign type according to MUTCD), sleeve (2-1/4 inch x 2-1/4 inch x 12 inches long square tubing) and anchor (2 inch x 2 inch x 36 inches long square tubing).

(A) Material: Tubing shall be roll formed of 12 gauge steel or of a gauge sufficient to supply a minimum yield strength of 40,000 psi. Tubing shall conform to the Standard Specifications for Cold-Rolled Carbon Steel sheets, commercial quality, ASTM A-570, Grade 33 for plain finish, and ASTM A-446, Grade A for galvanized finish.

(B) Finish:

(1) Galvanized: All steel tubing shall be given a hot dipped zinc (galvanized) coating conforming to ASTM A-525, G-90. All exterior, interior, and corner weld surfaces shall be thoroughly coated.

(2) Painted: Galvanized tubing shall be cleaned and phosphated prior to application of a powder coat finish. The tubing shall be coated with polyester powder bake/fused or electrodeposited to the galvanized surface. The color is Perma-Green per Federal Standard 595-A, color number 14109 (dark limit V).

(C) Shape: A cross section of the post shall be a square tube carefully rolled to size. Tubing shall be corner welded by high intensity resistance welding, in such a manner that neither the weld nor flash shall interfere with telescoping properties.

(D) Holes or Knockouts: Hole or knockout diameter shall be 7/16-inch plus or minus 1/64-inch on 1 inch centers, on all 4 sides of the post for its entire length. Holes or knockouts shall be on the center line of each

side in true alignment and placed opposite and adjacent to each other. Tolerance on hole or knockout spacing is plus or minus 1/8-inch in 4 feet. The sleeve and post tubing shall have the first two sets of knock outs pre-punched on one end.

(E) Telescoping Properties: The finished post, sleeve and anchor shall be straight and have a smooth uniform finish. It shall be possible to telescope the post with each consecutive larger and smaller size of square tube, freely and for not less than 10 feet of their length without the necessity of matching any particular face to any other face. All ends shall be free from burrs and shall be cut square.

(F) Anchor/Sleeve Installation: The Contractor shall install the anchor/sleeve by driving with a pneumatic hammer or by encasing in concrete.

(1) Pneumatic Hammer: The sign anchor and sleeve may be installed with a pneumatic hammer. The Contractor shall exercise extreme care to prevent deformation of the anchor tubing during installation. The sign post must be able to slide freely in and out of the anchor once it is in place.

(2) Concrete Encased: The sign anchor and sleeve may be wrapped with #30 tar paper and concentrically placed in an 8 inch diameter by 42 inch deep concrete encasement. The anchor tubing shall extend 35 inches into the concrete encasement. The sign post must be able to slide freely in and out of the anchor once it is in place.

402.3.2 Advance Street Name Signs:

(A) Material:

(1) Background shall be green, Type III sheeting per ASTM standard specifications, sometimes referred to as "high-intensity".

(2) Legend shall be silver, Type III sheeting per ASTM standard specifications, sometimes referred to as "high intensity".

(3) The sign width shall be a standard 18 inches. The sign length shall be variable and sized according to legend. The minimum length shall be 42 inches and maximum length shall be 72 inches.

(4) All vinyl sheeting shall carry a 10-year guarantee not to lose more than 20 percent of initial reflectivity by the end of a 10-year period.

(B) Sign Fabrication:

(1) All letters and numerals shall be Series "C". The first letter in each name shall be 8-inch upper case. All other letters shall be 6-inch lower case. In the event that a street name length will not fit on the maximum 72-inch blank, the letters shall be changed to Series "B". The street designation such as, Road, Street, etc., shall be abbreviated and may be down sized to a minimum of 4 inches. These adjustments are to be made only when the street name is of such length that it will not fit on a 72-inch blank.

(2) All street names shall be properly centered on a sign blank.

(C) Sign Installation:

- (1) Sign installations shall be made in a high quality manner. All signs shall be level within 2 degrees. Sign poles shall be perpendicular to level plus or minus 2 degrees. Signs shall be installed at a height of 4 feet to the bottom of the sign.
- (2) All signs shall be secured to each pole with no less than 2 each, 3/8-inch steel drive rivets.
- (3) Signs over 60 inches in length will require 3 sign posts, equally spaced and centered on the sign.
- (4) All signs must be clean and free of any contaminant upon completion of installation.
- (5) The Engineer shall designate all sign locations, away from trees and other vegetation that may obstruct visibility.

402.3.3 Street Name Signs:

(A) Materials:

- (1) Sign sheeting shall be ASTM Type II (super engineer grade) per ASTM Standard Specifications. Background color shall be green, legend color shall be white.
- (2) Sign blanks shall be 9 inch-extruded aluminum blank, 0.091 gauge.
- (3) Aluminum shall be chemically treated to meet ASTM B449 specification for corrosion resistance.

(B) Sign Fabrication:

- (1) Letters for street name shall be upper case, 4-inch Series "C", Helvetica, medium stroke.
- (2) Letters for block number, street direction and street designation (ST., RD., PL.) shall be upper case, 2-inch, Series "C", Helvetica, medium stroke.
- (3) Letters and numbers for numerical streets shall be 4-inch (ie. ^E 5 TH₇₂₀₀AVE).

402.3.4 Metro Street Signs

(A) General:

- (1) **Workmanship:** All items shall be new; the material and workmanship shall be of the best quality for the purpose.
- (2) **Drawings:** All signs shall be made in accordance with the COS Standard Details. All sign layouts shall be the Contractor's responsibility and shall be subject to the COS's Traffic Engineering Division's approval.
- (3) **Warranty:** Any sign delivered under this contract which does not conform to these specifications shall be replaced by the Contractor at no cost to the Engineer.

(B) Materials and Fabrication:

(1) Powder Coating: Aluminum frame and telescoping bracket shall be covered with opaque electrostatically applied TGIC POLYESTER POWDER COATING.

(a) Thickness: The thickness of the TGIC Powder Coating fused to the aluminum frame and telescoping bracket shall be .002-inch minimum. Thickness shall be determined in accordance with ASTM Designation D-1400, or other methods of equivalent or greater accuracy. The referee method, in case of dispute, shall be photomicrography.

(b) Color: Color shall be white TGIC Powder Coating on the mounting bracket and frame.

(2) 3M Diamond Grade Reflective Sheeting, ASTM Proposed Type IX (prismatic lens sheeting):

(a) Color shall be white legends on green background.

(b) The application and screening procedures must be in accordance with the sheeting manufacturer's specifications. May be applied or screen printed.

(3) Base Metal:

(a) Description: The base metal substrate shall be new sheet aluminum alloy 3003-H14 or 5052-H32.

The thickness of the aluminum shall be .125-inch. The material shall be subject to inspection prior to degreasing and chromate conversion coating operations. Alloy and temper designations shall be verified by mill test certifications.

(b) Shearing: All sign panel edges shall be shear-trimmed or roll-slit to produce neat edges and rounded corners. Sign panel edges shall be straight within 1/32-inch from the straight plane. Edge delamination or incomplete coverage of the base metal substrate up to and coincident with the cut edge of the sign panel shall be sufficient basis for rejection of the entire sign panel.

(c) Pretreatment: All treatment tanks and/or spray applied systems must be performed on the Contractor's premises, to ensure proper adhesion of powder or reflective sheeting materials. All treatment tanks or spray applied systems shall be charged with fresh chemicals at least once a year. If pretreatment is performed by immersion methods, the tanks must be sufficient size to accommodate the complete panel. Titration equipment shall be available for the inspectors to check the solutions' strengths. The cleaned and coated base metal shall be handled only by a mechanical device or by operators wearing clean cotton or rubber gloves. After cleaning and coating operations, the panels shall be protected at all times from contact or exposure to grease, oils, dust or other contaminants.

The front and back surfaces of the aluminum base metal shall be cleaned, deoxidized, and coated with a light, tightly adherent chromate conversion coating free of any powdery residue. The base metal pretreatment process shall be in conformance with Section 5, "Recommended Processing Methods" of ASTM Designation B-449. The coating weight shall be (30-100 mg/sq.ft.) a class 1 coating.

(4) Sign Message:

(a) The following letters/border sizes shall be used:

- (1) Street legend 10-inch uppercase Series "D" or "C";
 - (2) Suffix and block number legend 4-inch uppercase Series "D" or "C";
 - (3) Arrow size 8-3/4 inches x 4-inches;
 - (4) One-inch border.
- (b) The number of characters helps determine the length of each sign.
- (5) Sign Frame & Panel Construction:
- (a) Frames: The frame shall be aluminum channel extrusion, 1/25-inch x 1.25-inch x .125-inch wall thickness. Alloy 6063-T5. All joints of the aluminum channel shall be miter cut to form a 45-degree angle at each corner. The frame shall be welded with an inert gas shielded-arc welding process using 4043 electrode filler wire in accordance with good shop practice. The width of the filler wire shall be equal to the wall thickness of the channel being welded.

The top of the frame will have two 2-inch x 2-inch x .250-inch wall thickness channel members welded and fastened to the frame with stainless steel bolt, washer, ny-lock nuts and cotter pins. The adjustable swing assembly will be attached to these members as shown on the drawing.

(b) Assembly: A sign panel shall be fastened to both sides of the channel frame to make a double-faced unit. Each sign panel must be a continuous sheet, with no vertical or horizontal splices to make up one panel.

The sign panels shall be affixed to the frame with 3/16-inch diameter blind pop rivets, alloy 5052, or a type approved by the COS Traffic Engineering Division. They must be aluminum approved. The exposed face of the rivet shall be of similar shade and compatible with the face color of the finished sign. The rivets shall be placed through the face of the sign with the wall of the channel placed against the back of the sign panel. Rivets shall be placed no closer than 1/2-inch from the edge of the sign panel and a maximum of 8 inches apart from one another. All rivets must penetrate the web of the channel frame for proper grip strength between sign panel and frame.

The swing hinge is attached to the 2-inch x 2-inch channel member with a 1/4-inch stainless steel bolt and bronze bushing, and then secured with a ny-lock nut. Total assembly with fasteners per spec drawing.

(c) Mounting Assemblies: The top of the sign frame shall have two free swinging mounting brackets. They shall be of all aluminum, bronze, and stainless steel parts. The 5-inch long stainless steel bolt allows for fine adjustments. Dampening springs shall be used. Each of the swing brackets shall be adjusted vertically for leveling the sign to either a straight or curved mast arm. The bracket assembly shall permit the sign unit to swing perpendicular to the support hardware.

The hardware used to attach the sign and swing assembly to the mast arm will be "L-brackets" and "Y-brackets".

The "L-bracket" shall be a two-piece telescoping design to adjust from 17 inches to 21 inches in 1-inch increments without additional adapters required. The tubing shall be 6063-T6 aluminum extrusion. The

outside tube shall be 1.5 inches x 1.25 inches x .150 inch wall with one wall .375 inch thick and threaded for two 3/8-inch stainless steel holding bolts with external tooth lock washers. The inside tube shall fit firm within each other to slide smoothly. Safety Tabs must be located on the ends of each tube. These tabs will not allow the tubes to completely separate from each other during shipping and installation procedures. When installing the telescoping L-bracket, the outside tube should be extended first, then the inside tube.

The "Y-bracket" shall be a one-piece solid 6063-T6 extrusion construction. There shall be four slots in the brackets to accommodate two 3/4-inch wide stainless steel straps side by side. The strapping shall be a minimum of .020-inch thick. The L-bracket shall attach to the Y-bracket with a 1/2-inch stainless steel bolt, lock washer and ny-lock nut.

When installation of the sign to the mast arm is complete, the sign should swing freely 90 degrees in both directions when moved by the installer without any binding or hindrance felt. The sign will then move freely under normal weather conditions.

(d) Finish: The finished sign shall be flat within a ratio of 0.040-inch per linear foot when measured across the plane of each from opposite corners or at any location on the panel. All finished signs shall have a smooth flat surface without defects or objectionable marks of any kind on either the front or the back faces. All letters and designs shall be clearly cut and sharply defined.

The appearance of the sign face shall be uniform throughout and shall be free of wrinkles, gel, hard spots, streaks, extrusion marks, air bubbles or blemishes that may impair the serviceability, detract from the general appearance or color-matching of the sign when viewed from a distance of twenty-five (25) feet.

The finished sign shall be clean and free from all burrs, sharp edges, loose rivets and aluminum marks.

Signs with any defects or damage that affect their appearance and serviceability will not be acceptable. All metal parts shall be fabricated in a uniform and quality workmanlike manner with all sign surfaces and edges free of defects. No repairs shall be made to the face sheet without the approval of the entities' inspectors.

(C) Packaging: Packaging must be in accordance with the sheeting manufacturer's specifications. All signs shall be packaged in such a manner to insure delivery in perfect condition and shall be suitable protected for proper shipment and storage.

For approved equals and further details, please call the COS Field Services Signs & Markings Department at (480)312-5623 or (480)312-5646.

402.3.5 Measurement and Payment: All signing (except metro street signing) will be measured as the total square footage of reflective signing material and linear footage of square tubular steel sign post material. Sign anchor/sleeves will be measured each.

Metro street signing will be measured as a complete assembly, including all mounting hardware, for each sign installed as described herein.

Payment for signing will be at the unit costs as indicated in the bid schedule and will be considered full compensation for the work as described herein and as shown on the plans.

Add the following section:

**SECTION 403
TRAFFIC SIGNALIZATION**

403.1 DESCRIPTION:

This specification describes the general requirements for traffic signal equipment to be installed within, or supplied to, the City of Scottsdale.

403.2 GENERAL REQUIREMENTS:

(A) All traffic signals and lighting equipment shall conform to the following documents, where applicable, in addition to meeting the requirements of this specification:

- Arizona Department of Transportation, Standard Specifications for Road and Bridge Construction: Latest revision
- Arizona Department of Transportation, Traffic Signals and Lighting, Standard Drawings: Latest revision
- California Department of Transportation, Traffic Signal Control Equipment Specifications: Latest revision
- International Municipal Signal Association (IMSA), Wire and Cable Specifications: Latest revision
- National Electrical Manufacturers Association, Traffic Control Systems, Standards Publications: Latest revision
- U.S.D.O.T. / F.H.W.A., Manual on Uniform Traffic Control Devices: Latest revision
- American Association of State Highway and Transportation Officials, Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals: Latest revision
- U.S.D.O.T. / F.H.W.A., Type 170 Traffic Signal Controller System - Hardware Specification: 1978
- COS Design Standards and Policies Manual, Latest edition.
- COS Traffic Signal Special Requirements Manual, Latest edition.
- COS Traffic Engineering Division Qualified Products List, Latest version.

(B) All traffic signal poles with pedestrian push button assemblies shall be wheel chair accessible. A four (4) foot wide concrete access ramp and landing per A.D.A. requirements shall be provided to poles which are not placed immediately adjacent to sidewalks. Pedestrian push button assemblies shall be mounted no higher than 42" above the adjacent sidewalk or ramp elevation. All pedestrian push buttons shall be A.D.A. compliant.

- (C) **Personnel Requirement and Notification:** All traffic signal construction must be staffed with two or more IMSA Level II Traffic Signal Technicians during all wiring and/or turn on phases of construction or one ISMA Level II Technician and one ISMA Level I Technician at the discretion of the COS Traffic Signal Supervisor. Prior to the start of construction, written proof of technician certification must be delivered to the COS Traffic Signal Supervisor along with company name, contact name, phone number, job location and estimated start date. The COS Traffic Signal Section can be reached by phone at (480)312-5635, by FAX at (480)312-5539, or by mail at 9191 E. San Salvador, Scottsdale, AZ 85258.
- (D) **Inspection Request Notification:** In addition to normal inspection request procedures, the Contractor must FAX an inspection request to the COS Traffic Signal Supervisor at least 3 working days prior to the completion of each of the following inspection points:
- 1) Pre-Construction Conference
 - 2) Concrete pour
 - 3) Backfill of conduit runs
 - 4) Pole run and/or underground wire pulls
 - 5) Cabinet installation and wiring
 - 6) Signal turn-on

FAXed inspection request shall contain all information stated in section 403.2(C) except proof of technician certification. Information shall be FAXed using COS Inspection Request Form which can be found at the COS Internet website below.

COS Traffic Signal Special Requirements Manual, Latest Edition can be obtained from the COS Signal *Supervisor or can be found on the COS Internet website at <http://www.scottsdaleaz.gov/Design/TrafficSignalSpecs/>. This manual should be reviewed prior to beginning any signal construction and will help signal contractors to avoid rework.

(E) **PEDESTRIAN SIGNALS**

- a. Contractors building signals in high pedestrian areas of Scottsdale shall install audio crosswalk devices into pedestrian units. Audible indications shall be "Cuckoo" for North-South 800 Hz & 1200 Hz repeating approximately every 1.5 seconds and "Chirp" for East-West 2000 Hz which repeats approximately every one-second. Devices shall be wired to the "WALK" indication.
- b. Pedestrian signals shall be "LED", 9-inches in height, have bottom hinges, and consist of the international "man/hand" symbol.

(F) **ELECTRIC SERVICE CABINETS**

- a. All electrical service cabinets must meet APS and SRP requirements and must include Photocell Eye, Luminaire contactor and Auto/Test switch. All cabinets shall have detachable base and match existing COS cabinets.
- b. The electric service cabinet shall be "MEYERS" model MEUGL-W/TB or approved equivalent. The service address shall be permanently attached to the electric service cabinet. Electric service shall include photocell eye, luminaire contactor, and auto/test switch.

(G) CONTROLLER CABINET AND CONTROLLER UNIT

*a. The controller unit shall be model 170ATC/HC11 and shall be compliance with Oregon Department of Transportation Standard Specification for Microcomputer Traffic Signal Controller dated July 20 2000 – 170ATC and HC-11 Version. The HC11 CPU board shall meet the specification requirements in subparagraph b. The controller cabinet shall be model 330, with a 12” extender *that has a removable front panel with a minimum size of 8in. x 8 in.*

b. SPECIFICATION FOR MODEL HC-11 CPU BOARD. This specification complies with the requirements in the TRAFFIC SIGNAL CONTROL SPECIFICATION, Dated January 1989 and the November 19, 1993 TSCES addendum #8 – Specification for the Model 170E enhanced Controller Unit and associated Model 412C and Model 172 Modules, with the exception that the 170 Controller/Unit and details related to the Model 170E/ Model 412C Module are superceded by the following HC-11 CPU Specification. When conflicts arise between the specifications this HC-11 specification shall take precedence.

SPECIFICATION FOR MODEL HC-11 CPU BOARD

- i. The purpose of this specification is to define a replacement CPU board for the 6800 based CPU board in the standard 170 E controller.
- ii. The HC-11 based CPU Module shall operate a 68HC11F1 MPU to replace the existing 6800 MPU installed in the existing 170E CPU board. The MPU shall operate with a crystal frequency of 8MHz. The MPU chip shall be socket mounted in an AMP PLCC socket #821574-1 series HPT or equal.
- iii. The 6850 communication IC’s shall be used and shall operate with a crystal frequency of 6.144 MHz. There shall be four (4) chips (6850) with programmable jumpers to select 5 different communication baud rates per chip (1200, 2400, 4800, 9600, and 19200) for a total of 20 jumpers. There shall be no IRQ inhibits provided therefore all ACIA’s shall be active. Programs should be written to initialize the four communications chips upon startup. An IRQ status register shall be provided as defined in the 170 E CALTRANS spec.
- iv. The EPROM and RAM shall be resident on the CPU board, and shall be socket mounted. The EPROM socket shall be a 32 pin ZIF force device. The RAM socket shall be a 28 pin Augat 828 series or equal.
 1. Ram will be continuous from locations \$0000 to \$6FFF. RAM shall be a ZERO power device exclusively, and be a Dallas 1230 or equal.
 2. When an optional RTC clock is required, the RAM shall be a DALLAS 1644 or equal. (Clock address shall be in the I/O map at location \$7FF8 to \$7FFF.)
 3. A jumper select shall be provided to switch locations \$6000 to \$6FFF from Internal to External for access to the remote Dual Port location. The status of the jumper position shall be read on the IRQ register - bit five (5).
 - a. When an enhanced Program Module is used with this system, it will only have access to addresses 6000/6FFF for dual-port.

4. The Prom chip shall be either a 32K X 8 or a 128K x 8 device, and be jumper selectable.
5. When using a 128K EPROM, a bank switch shall be enabled within the EPROM memory system. This bank switch shall function by moving to the upper 64K segment of the EPROM. The bank switch jumper controls address line A16. The bank shall be activated by a write to location \$7002 (directly connected to Port G on HC-11 MPU), which will cause memory to go to the upper 64K of the 128K EPROM. This will enable an extra 32K of EPROM memory via bank switching. The status of A16 will be read on the IRQ status register - bit six (6).
- v. Feature and location switches shall be provided on the front portion of the CPU board. Each switch shall be an eight-position front reading dip switch. These switches shall be decoded as follows:
 1. Features switch shall be addressed at \$700A – Port E
 2. Location switches shall be addressed at \$7000 – Port A
- vi. A header shall be provided near the front of the module for the SPI and serial interface pins.
- vii. There shall be one LED indicator located on the front of the CPU board, that shall be controlled via a software output of Port G bit 3.
- viii. The +12VDC, +5VDC and +/-12 VDC voltages input to the CPU board shall have transorb protection.
- ix. The system address organization of the HC-11 Module shall consist of two addressing configurations. The decoder shall be furnished in address 1.
 1. The two addressing configurations shall be selectable by use of a three- post jumper. The following input line state conditions shall cause the Decoder to provide the associated address configuration. The jumper shall be labeled "INT" and "EXT".

CONFIGURATION	LINE	FUNCTION
1	INT	Address 6000-6FFF shall reside on the internal RAM
2	EXT	Address 6000-6FFF shall reside on the external Program Module

HC11 BASED 170 MEMORY MAP

Configuration 1

LOCATION	BLOCK SIZE	FUNCTION	NOTES
0000-5FFF	24K	170 RAM	CPU BOARD RAM

6000-6FFF	4K	RAM	INT JUMPER POSITION (* See Note below)
7000-73FF	1K	CONFIG REG + RAM	INITIATE IMMEDIATELY ON START UP
7400-75FF	512 BYTES	I/O	EXTERNAL I/O FUNCTIONS
7600-7FFF	2K	RAM	CPU BOARD RAM
8000-FFFF	32K	EPROM	CPU BOARD PROM MEMORY
DETAILED BLOCK ALLOCATION			
LOCATION	BLOCK SIZE	FUNCTION	NOTES
700A	1 BYTE	SWITCH	FEATURE SWITCH/HC11 PORT E
7000	1 BYTE	SWITCH	LOCATION SWITCH/HCLL PORT A
7002	1 BYTE	BANK SELECT	PROM BANK SWITCH SELECT HC11 PORT G - BIT 1
7002	1 BYTE	STATUS INDICATOR	HC11 PORT G - BIT 3 1=ON
7000-705F	96 BYTES	CONFIG. REG.	68HC11 CONFIG REGISTERS
7060-73FF	1K (-96)	RAM	68HC11 RAM
7400	1 BYTE	DTA MINUTES	I/O DTA READ MINUTES
740F	1 BYTE	DTA SECONDS	I/O DTA READ SECONDS
7401-740A	10 BYTES	I/O	I/O READ AND WRITE
7410-7417	8 BYTES	ACIA	SERIAL PORTS 1-4
7500-7507	8 BYTES	DPR	DUAL PORT SEMAPHORES
75FF	1 BYTE	IRQ/STAT	60 HZ. RESET AND IRQ STATUS
7600-7FF7	2K	RAM	CPU BOARD RAM

7FF8-7FFF	8 BYTES	RESERVED	RESERVED CLOCK/CALENDAR OPERATION
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NOTE: EXT JUMPER POSITION is CONFIGURATION #2 – Configuration #2 Redirects addresses 6000-6FFF to the Prom Module Slot.

(H) CABINET FOUNDATIONS

- a. If foundations are removed, they shall be removed to at least 12 inches below grade or as directed by the COS inspector.
- b. The electrical service cabinet shall project 12 to 18 inches above the adjacent ultimate ground elevation. The controller cabinet shall project above grade and have 12” base extender mounted. The cabinet foundations shall extend 32 to 36 inches below the adjacent ultimate ground elevation. Both foundations shall have a “technician pad” which shall be the width of the foundation extending 24” from base and be 4” above grade.
- c. Both cabinet and foundations shall have 4” above grade “tech pads” installed in front.

(I) SIGNAL HEADS

- a. All indications shall be “LED” type lamps. All pedestrian indications shall also be “LED” type lamps. LEDs shall approved by Traffic Signals Manager, Norm Akin (480) 312-5634.
- b. follows:
watts
- c. Signal heads shall be reinforced polycarbonate with ribbed or fiberglass reinforcement and lenses must be glass.
- d. Heads and mounting brackets shall be black.

(J) CONDUIT & CONDUCTORS

- a. Galvanized conduit shall be used for exposed, aboveground runs through the first sweep below grade.
- b. Warning tape shall be placed in all trenches 12 inches below final grade.
- c. Expansion joints shall be used every 50 feet.
- d. Schedule 40 PVC shall be used except for service runs above ground.
- e. All cables must be taped and color-coded as shown in the tables below. Detector and pre-emption wires should be taped the same as the signal wires. Spares shall be taped brown. Telecommunication cable shall be taped orange.

If there are only 4 phases, use the first cable colors with no tape around the cables. If 8 phases are used, use the first and second cable colors but tape the second cables white. Each individual conductor in the cables gets taped regardless of whether 4 or 8 phases are used.

First Cable Colors

PHASE	RED INDICATION	YELLOW INDICATION	GREEN INDICATION
1	Solid Red	Solid Orange	Solid Green
2	Black Traced Red	Black Traced Orange	Black Traced Green
3	White traced Red	White Traced Blue	White Traced Green
4	Green Traced Red	Red Traced Orange	Red Traced Blue
PHASE	DON'T WALK		WALK
2 Pedestrian	Solid Black		Solid Blue
4 Pedestrian	White Traced Black		Black Traced Blue
2 Push Button	Red Traced White		
4 Push Button	Red Traced Black		
Push Button Neutral	Solid White		
Spare	Black Traced White		

Second Cable Colors—Place a *WHITE* piece of tape around each *CABLE*

PHASE	RED INDICATION	YELLOW INDICATION	GREEN INDICATION
5	Solid Red	Solid Orange	Solid Green
6	Black Traced Red	Black Traced Orange	Black Traced Green
7	White traced Red	White Traced Blue	White Traced Green
8	Green Traced Red	Red Traced Orange	Red Traced Blue
PHASE	DON'T WALK		WALK
6 Pedestrian	Solid Black		Solid Blue
8 Pedestrian	White Traced Black		Black Traced Blue
6 Push Button	Red Traced White		
8 Push Button	Red Traced Black		
Push Button Neutral	Solid White		
Spare	Black Traced White		

Tape Colors—Place the appropriate color tape around each *PHASE SET*

NB	SB	EB	WB
Red	Yellow	Green	Blue
NBLT	SBLT	EBLT	WBLT
Red + White	Yellow + White	Green + White	Blue + White
NBRT	SBRT	EBRT	WBRT
Red + Black	Yellow + Black	Green + Black	Blue + Black

(K) PULL BOXES

- a. All pull boxes shall be marked "TRAFFIC SIGNAL" on the lid. Pull box lids shall be fiber composite type.
- b. Only pull boxes ADOT #5 and ADOT #7 shall be used.
- c. Concrete pull boxes with steel covers shall be used in all dirt areas and in sidewalks. Placement of pull boxes in sidewalks shall be avoided whenever possible.

(L) LIGHTING

- a. Luminaire wire connections shall only be made in pull boxes and not brought into the signal controller cabinet.
- b. Intersection lighting shall be 120 volt, 250 watt, two door, 90-degree cutoff with filter. Luminaires shall include one photocell for each luminaire.

(M) UPS – Some intersections will be equipped with an uninterruptible power supply (UPS) as directed by COS Traffic Engineering or Traffic Operations. At locations with a UPS, all indications including yellow pedestrian indications shall be "LED" type. UPS foundation shall meet same requirements as cabinet foundations.

403.3 MATERIALS:

403.3.1 Traffic Signal Structures:

(A) General: A traffic signal structure is defined as a complete pole and mast arm assembly attached to a concrete foundation for the purpose of supporting traffic signals, street lights, and signs. The traffic signal structure shall as a minimum consist of the following parts:

- pole shaft
- signal mast arm
- luminary mast arm (if required)
- foundation anchor bolts plus hardware
- mast arm pole connecting hardware
- top cap hardware
- pole hardware
- concrete foundation and steel reinforcing (if required)
- protective coating

(B) Qualified Products List (QPL)

- (1) A City of Scottsdale Qualified Products List has been established for traffic signal structures.
- (2) Contractors are not required to submit documentation on qualified products for review by the City.
- (3) All Contractors bidding traffic signal structures which are not on the City QPL are required to submit the following documentation for City review:

- (a) Traffic signal structure drawings.
 - (b) Traffic signal structure specifications.
 - (c) Traffic signal structure load calculations (based on the maximum City loading) and a letter signed and stamped by a Professional Engineer registered in the state of Arizona stating that the signal structure will safely support the maximum loading as described by the City.
 - (d) Documentation of all deviations from ADOT specifications.
 - (e) Recommended foundation designs and specifications for all traffic signal structures, except the ADOT / Scottsdale standardized traffic signal structures.
- (C) Traffic Signal Structures ADOT/Scottsdale - The base specification and warranty requirements for the ADOT /Scottsdale traffic signal structure shall be:
- Arizona Department of Transportation, Standard Specification for Road and Bridge Construction: Latest Revision.
 - Arizona Department of Transportation, Traffic Signals and Lighting, Standard Drawings: Latest Revision.

**SECTION 430
LANDSCAPING AND PLANTING**

MAG Section 430 LANDSCAPING AND PLANTING is deleted in its entirety and the following section substituted:

**SECTION 430
LANDSCAPING AND PLANTING**

430.1 SUMMARY

This Section includes the following:

1. Trees.
2. Shrubs.
3. Ground covers.
4. Plants.
5. Lawns
6. Topsoil and soil amendments.
5. Proper staking.
6. Landscape edgings.

430.2 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract.
- B. Product certificates signed by manufacturers certifying that their products comply with specified requirements.
 1. Manufacturer's certified analysis for standard products.
 2. Analysis for other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
 3. Label data substantiating that plants, trees, shrubs, and planting materials comply with specified requirements.
- C. Certification of grass seed from seed vendor for each grass-seed mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed content. Include the year of production and date of packaging.
- D. Samples of each of the following:
 1. 5 lb (2 kg) of granite stone mulch for each color and texture of stone required for Project, in labeled plastic bags.
- E. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and address of architects and owners, and other information specified.
- F. Material test reports from qualified independent testing agency indicating and interpreting test results relative to compliance of the following materials with requirements indicated.
 1. Analysis of imported topsoil (by certified soil laboratory).

- G. Planting schedule indicating anticipated dates and locations for each type of planting.
- H. Maintenance instructions recommending procedures to be established by Owner for maintenance of landscaping during an entire year. Submit before expiration of required maintenance periods.
- I. Adhere to the City of Scottsdale Native Plant Ordinance and make necessary submittals to obtain a Native Plant permit.

430.3 QUALITY ASSURANCE

- A. **Installer Qualifications:** Engage an experienced Installer who has completed landscaping work similar in material, design, and extent to that indicated for this Project and with a record of successful landscape establishment.
 - 1. **Installer's Field Supervision:** Require Installer to maintain an experienced full-time supervisor on the Project site during times that landscaping is in progress.
- B. **Testing Agency Qualifications:** To qualify for acceptance, an independent testing agency must demonstrate to Architect's satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM E 699, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.
- C. Provide quality, size, genus, species, and variety of trees and shrubs indicated, complying with applicable requirements of ANSI Z60.1 "American Standard for Nursery Stock."
- D. **Topsoil Analysis:** Furnish a soil analysis made by a qualified independent soil-testing agency stating percentages of organic matter, inorganic matter (silt, clay, and sand), deleterious material, pH, and mineral and plant-nutrient content of topsoil.
 - 1. Report suitability of topsoil for growth of applicable planting material. State recommended quantities of nitrogen, phosphorus, and potash nutrients and any limestone, aluminum sulfate, or other soil amendments to be added to produce a satisfactory topsoil.
- E. **Measurements:** Measure trees and shrubs according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches (150 mm) above ground for trees up to 4-inch (100-mm) caliper size, and 12 inches (300 mm) above ground for larger sizes. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.
- F. **Preinstallation Conference:** Conduct conference at Project site prior to planting of trees and shrubs with City owners and contractor discuss the COS Parks Department planting details.

430.4 DELIVERY, STORAGE, AND HANDLING

- A. **Packaged Materials:** Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery and while stored at site.
- B. **Trees and Shrubs:** Do not prune before delivery, except as approved by COS Parks Department Representative. Protect bark, branches, and root systems from sunburn, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy natural shape. Provide protective covering during delivery. Do not drop trees and shrubs during delivery of all plant material, this includes flatbed semi-trailer.

- C. Deliver trees, shrubs, ground covers, and plants after preparations for planting have been completed and install immediately. If planting is delayed more than 6 hours after delivery, set planting materials in shade, protect from weather and mechanical damage, and keep roots moist. Contractor is responsible for providing water to plant material on site.
 - 1. Do not remove container-grown stock from containers before time of planting. Option of COS Parks Department to sample 2% of lot material.
 - 2. Water root systems of trees and shrubs stored on site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.

430.5 PROJECT CONDITIONS

- A. Utilities: Determine location of above grade and underground utilities and perform work in a manner which will avoid damage. Hand excavate, as required. Maintain grade stakes until removal is mutually agreed upon by parties concerned.
- B. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Architect before planting.
- C. Clean backfill (native backfill) no rocks larger than ½" diameter.

430.6 COORDINATION AND SCHEDULING

- A. Coordinate installation of planting materials during normal planting seasons for each type of plant material required.
- B. Scheduling: Irrigation system shall be operational in both landscape and turf areas before being planted.
- C. Turf:
 - October-March – overseed bermuda sod
 - March-October 1 – bermuda sod
 - June 1-June 15 -hybrid stolens for areas which will be overseeded.
 - June 1-July 15 – Selected Bermuda seed type or hybrid stolens if turf will not be overseeded.
 - August 1 – September 30 – No sod to be installed until overseeded Bermuda sod is available.

430.7 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Special Warranty: Warrant the following living planting materials for a period of one year after date of Final Completion, against defects including death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, or abuse by Owner, abnormal weather conditions unusual for warranty period, or incidents that are beyond Contractor's control.
- C. Remove and replace dead planting materials immediately. All plants to be replaced in-kind

size specified in the original design.

- D. Replace planting materials that are in an unhealthy condition at end of warranty period.

430.8 TREE AND SHRUB MAINTENANCE

- A. Maintain trees and shrubs by cultivating, watering, weeding, fertilizing, following COS Parks Department planting details, tightening and repairing stakes, and resetting to proper grades or vertical position. Spray as required to keep trees and shrubs free of insects and disease. Maintain trees and shrubs for the following period:
 - 1. Maintenance Period: 3 months following final acceptance.

430.9 GROUND COVER AND PLANT MAINTENANCE

- A. Maintain ground cover and plants by watering, weeding, fertilizing, and other operations as required to establish healthy, viable plantings for the following period:
 - 1. Maintenance Period: 3 months following final acceptance.

430.10 LAWN MAINTENANCE

- A. Begin maintenance of lawns immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:
 - 1. Seeded Lawns: 90 days after date of final acceptance.
 - a. When full maintenance period has not elapsed before end of planting season, or if lawn is not fully established at that time, continue maintenance during next planting season. Lawns shall be substantially complete when entire area is covered with uniformly and mowed to a uniform height of 1 ½ inch.
- B. Maintain and establish lawns by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and mulch to produce a uniformly smooth lawn.
- C. Watering: Provide and maintain temporary piping, hoses, and lawn-watering equipment to convey water from sources and to keep lawns uniformly moist to a depth of 4 inches (100 mm).
- D. Mow lawns as soon as there is enough top growth to cut with mower set at specified height for principal species planted. Repeat mowing as required to maintain specified height without cutting 1/3 height of the grass. Remove no more than 1/3 inch of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Never mow grass when wet, or frosted. All mowing schedules will be confirmed by COS Parks Department representative.
- E. Postfertilization: Apply fertilizer to lawn after first mowing and when grass is dry, then schedule water cycle.
 - 1. Use fertilizer that will provide actual nitrogen of at least 1 lb. Per 1,000 sq. ft. (0.5 kg per 100 sq. m) of lawn area.

430.11 PRODUCTS

430.11.1 TREE AND SHRUB MATERIAL

- A. General: Furnish nursery-grown trees and shrubs conforming to ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully-branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
- B. Grade: Provide trees and shrubs of sizes and grades conforming to ANSI Z60.1 for type of trees and shrubs required. Trees and shrubs of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.
- C. Label at least 1 tree and 1 shrub of each variety and caliper with a securely attached, waterproof tag bearing legible designation of botanical and common name.
- D. Plants protected by federal trademark or patent must include the correct name with genus and species along with registered cultivar name and be attached to all plants delivered and planted on specific project.

430.11.2 GRASS MATERIALS

- A. Grass Seed: Fresh, clean dry, new-crop seed complying with the Association of Official Seed Analysts' "Rules for Testing Seeds" for purity and germination tolerances.
 - 1. Seed Mixture: Provide Bermuda Triangle (mix of Sultan, Sidney and Yuma), 80% minimum germination, 85% minimum pure live seed, 0.5% maximum weed seed.
- B. Sod: Hybrid Bermuda 328 overseeded perennial rye with winter grass variety approved by COS Parks Department.
 - 1. Sod shall be ¾ inch thick.
 - 2. Size of sod pad shall be cut not less than 12 inches x 24 inches nor more than 42 inches x 96 inches. Torn or uneven ends are unacceptable.
 - 3. Sod shall not break apart when handled and be moist and fresh upon arrival to site.
 - 4. Sod shall be mowed prior to cutting.
 - 5. Sod shall be scrim free during installation.

430.11.3 DESERT RESTORATION

- A. Hydroseed: Seed mixture shall consist of the following varieties at the rates shown below. Seed mixture shall be applied with the wood fiber mulch slurry.

PLS#/ACRE	BOTANICAL NAME	COMMON NAME
2	ENCELIA FARINOSA	BRITTLEBUSH
1	VIGUERIA DELTOIDEA	SHRUBBY GOLDEN EYE
2	AMBROSIA DELTOIDEA	BURSAGE
4	PLANTAGO INSULARIS	INDIAN WHEAT
2	CASSIA COVESII	DESERT SENNA
1	LOTUS RIGIDA	ROCK PEA
1	GUITERREZIA MICROCEPHALA	SNAKEWEED
1	HALOPAPPUS ACRADENIUS	TURPENTINE BUSH

14 TOTAL PER ACRE

ALL SEED QUOTED IN PLS POUNDS PER ACRE.
PLS = PURE LIVE SEED = PURITY X GERMINATION SEED TO BE
BROADCAST ACCORDING TO RECOMMENDED RATES. RAKE
INTO SURFACE 1/4".

- B. Application rates of seed as specified are for Pure Live Seed (PLS). $PLS = (\% \text{ germination} + \% \text{ hard or dormant}) \times \% \text{ purity}$. Weed content of seed shall not exceed .05%.
- C. Binder: Binder shall be a free flowing, non-corrosive powder produced from natural plant gum of *Plantago Insulares* (Indian Wheat) such as Muciloid Tac or approved equal. Binder shall be applied at 40 lbs. per acre on slopes less than 3:1 and 80 lbs per acre on slopes 3 to 1 and above.
- D. Wood Fiber Mulch: Wood fiber mulch shall consist of a specially prepared virgin wood fiber processed to contain no growth or germination inhibiting factors. Further, the mulch shall be manufactured and processed so the wood cellulose fibers will remain in uniform suspension in water under agitation and will blend with seed, fertilizer, and other additives to form a homogeneous slurry. The processed mulch material shall have characteristics to form a blotter-like ground cover on application, with moisture and percolation properties and the ability to cover and hold seed in contact with the soil. Wood fiber mulch shall be applied at 2000 lbs per acre.

430.11.4 TOPSOIL

- A. Topsoil: ASTM D 5268, pH range of 5.5 to 8, 4 percent organic material minimum, free of stones ½ inch (25mm) or larger in any dimension, and other extraneous materials harmful to plant growth.
 - 1. Topsoil Source: Reuse surface soil stockpiled on the site for planter areas. Import topsoil for turf areas. Verify suitability of surface soil to produce topsoil meeting requirements and amend when necessary.
 - 2. Turf area topsoil shall be an organic material free of deleterious material with a pH of 5.5 to 8.0. Maximum soluble salts shall be 1500 ppm. Soil texture shall be as follows: sand 60%-90%, clay 10%-20%, silt 10%-20%. The soil shall be classified as loamy sand or sandy loam. Volume of stones, cinders, slag, or extraneous material shall not exceed five percent. Obtain topsoil from an offsite borrow area selected by the Contractor and approved by the Architect-Engineer. Onsite stockpiled topsoil may be used in planter areas if meeting the above specifications.

430.11.5 SOIL AMENDMENTS

- A. Sand: Clean, washed, natural or manufactured sand, free of toxic materials.
- B. Pete Humus: Finely divided or granular texture, with a pH range of 6 to 7.5, composed of partially decomposed Daota peat (other than sphagnum), peat humus, or reed-sedge peat.
- C. Sawdust or Ground-Bark Humus: Decomposed, nitrogen-treated, of uniform texture, free of chips, weed pathogens, stones, sticks, soil, or toxic materials.
 - 1. When site treated, mix with at least 0.15 lb (2.4 kg) of ammonium nitrate or 0.25 lb (4 kg) of ammonium sulfate per cu. Ft. (cu. M) of loose sawdust or ground bark.

- D. Manure: Well-rotted, unleached stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed pathogens, and material harmful to plant growth.
- E. Herbicides: EPA registered and approved, of type recommended by manufacturer.
- F. Water: Potable.

430.11.6 FERTILIZER

- A. Superphosphate: Homogenous commercial 0-45-0, phosphate mixture, soluble; minimum of 20 percent available phosphoric acid.
- B. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea-form, phosphorous, and potassium in the following composition:
 - 1. Composition: 1 lb per 1000 sq. ft. (0.5 kg per 100 sq. m) of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
 - 2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.
- C. Slow-Release Fertilizer: Granular fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in homogenous composition:
 - 1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.
- D. Tree and shrub fertilizer shall be a complete, commercially available inorganic material. Fertilizer shall contain sulfur coated slow release components.
- E. All fertilizers and application shall be as required by the soils analysis of the import soil.

430.11.7 MULCHES

- A. Peat Mulch: Provide Dakota peat moss in natural, shredded, or granulated form, of fine texture, with a pH range of 4 to 6 and a water-absorbing capacity of 1100 to 2000 percent.
- B. Fiber Mulch: Biodegradable dyed-wood cellulose-fiber mulch, nontoxic, free of plant growth- or germination-inhibitors, with maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.
- C. Asphalt Emulsion Tackifier: Asphalt emulsion, ASTM D 977, Grade SS-1, nontoxic and free of plant growth- or germination-inhibitors.
- D. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application, nontoxic and free of plant growth- or germination-inhibitors.
- E. Mineral Mulch: Hard, durable stone, washed free of loam, sand, clay, and other foreign substances, of following type, size range, and color:
 - 1. Type: Decomposed granite.
 - 2. Size Range: 1/2 inch (19 mm) maximum, 1/4 inch (6 mm) minimum.
 - 3. Color: Readily available natural gravel color range, similar to naturally occurring onsite materials.

430.11.8 WEED-CONTROL BARRIERS

- A. Pre-emergent type herbicide.

430.11.9 STAKES

- A. Upright Stakes: Comply with COS Parks Department Planting Detail. Round, 2 inch, pressure-preservative-treated lodge poles, free of knots, holes and other defects.
- B. Tie Wire: ASTM A 641 (ASTM A 641M), Class 1, galvanized-steel wire, 2-strand, twisted, 0.106 inch (2.7 mm) in diameter.
- C. Hose Chafing Guard: Reinforced rubber or plastic hose at least 1/2 inch (13 mm) in diameter, black, cut to lengths required to protect tree trunks from damage.
- D. Flags: Standard surveyor's plastic flagging tape, white, 6 inches (150 mm) long.

430.11.10 SOIL STABILIZER

- A. Stabilizer to be applied to desert pavement areas indicated on plans or approved equal by COS Parks Department representative.
 - 1. "Stabilizer" as manufactured by Stabilizer, 22nd Street & Magnolia, Phoenix, Arizona 85018, (602) 225-5900.
- B. Ballfield infield mix shall consist of crushed Coral granite fines, as processed by Fort McDowell Sand and Gravel and Stabilizer organic binder. Stabilizer is to be mechanically blended with the fines in a pug mill type blender with a metered feeder unit which mechanically measures Stabilizer to the fines at a rate of 20 lbs. Of Stabilizer per 1-ton of fines.

To ensure that a proper blend has been attained, Chuck Dixon at Turf Diagnostic and Design Lab, 310-A North Winchester, Olathe, Kansas shall conduct a Stabilizer recovery test, at the contractor's expense.

Submit two 1-gallon samples of fines, one before treatment and one after treatment. A Stabilizer recovery test will also be required for mound and homeplate mixes and warning track mix.

The Coral fines must meet the USDA particle size analysis in the range as follows for the infield mix:

	ACCEPTABLE RANGE
GRAVEL	0 – 2.0%
COARSE	30 – 35%
MEDIUM FINE SAND	45 – 50%
SILT AND CLAY	15 – 20%
BULK DENSITY	1.5
STABILIZER BINDER ORGANIC MATTER	1.0%
TOTAL PORE SPACE	41
UNIFORMITY COEFFICIENT CU	5.0

- C. Ballfield mound and homeplate mix will also be blended with Stabilizer, clay and Coral fines to the following specifications and must meet USDA particle size analysis as follows:

MOUND AND HOMEPLATE MIX

	RANGE	
GRAVEL	0 – 2”	
VERY COARSE		20 – 25%
COARSE	20 – 25%	
MEDIUM AND FINE		25 – 30%
SILT AND CLAY		50 – 60%
STABILIZER CONTENT 12 LBS. PER TON		.6%

- D. Ballfield warning track mix will consist of ¼” minus Coral granite and Stabilizer, which meet the following specifications:

WARNING TRACK MIX

¼”	100%
#4	99%
#8	74%
#10	68%
#16	51%
#30	34%
#40	27%
#50	21%
#100	12%
#200	6%
STABILIZER CONTENT 20 lbs. per ton	1.0%

430.11.11 GRANITE BOULDERS

- A. Boulders shall be surface select, free of equipment marks and cracks. Size as indicated on the drawings.

430.12 EXECUTION

430.12.1 EXAMINATION

- A. Examine areas to receive landscaping for compliance with COS Parks Department representative requirements and for conditions affecting performance of work of this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

430.12.2 PREPARATION

- A. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, and secure City of Scottsdale’s COS Parks Department representative for acceptance before the start of planting work.

430.12.3 PLANTING SOIL PREPARATION

- A. Before mixing, clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth.
- E. Mix soil amendments and fertilizers with topsoil at rates indicated for lawn areas. Delay mixing fertilizer if planting does not follow placing of planting soil within a few days.

- F. Tree and shrub backfill shall be native soil per COS Parks Department detail.
- G. For lawns, mix imported topsoil with recommended amounts of fertilizer and 1/10 percent (by volume) Dakota peat mulch.

430.12.4 LAWN PLANTING PREPARATION

- A. Limit subgrade preparation to areas that will be planted in the immediate future.
- B. Loosen subgrade to a minimum depth of 4 inches (100 mm). Remove stones larger than ½ inches (38 mm) in any dimension and sticks, roots, rubbish, and other extraneous materials.
- C. Spread planting soil mixture to a minimum depth of 12 inches, after light rolling and natural settlement.
- D. Grade lawn and grass areas to a smooth, even surface with loose, uniformly fine texture. Roll and water settle, rake, remove ridges, and fill depressions to meet final grade. Limit fine grading to areas that can be planted in the immediate future. Remove trash, debris, stones larger than ½ inch (38 mm) in any dimension, and other objects that may interfere with planting or maintenance operations.
- E. Moisten prepared lawn areas before planting when soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- F. Restore prepared areas if eroded or otherwise disturbed after fine grading and before planting.

430.12.5 EXCAVATION FOR TREES AND SHRUBS

- A. Pits and Trenches: Excavate with vertical sides and with bottom of excavation slightly raised at center to assist drainage. Loosen hard subsoil in bottom of excavation.
 - 1. Container-Grown Trees and Shrubs: Excavate to 1-1/2 time the container width. Follow COS Parks Department planting detail.
- B. Obstructions: Notify Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.
 - 1. Hardpan Layer: Increase planting pit.
- C. Fill excavations with water and allow to percolate out, before placing setting layer and positioning trees and shrubs.

430.12.6 PLANTING TREES AND SHRUBS

- A. Set container-grown stock plumb and in center of pit or trench with top of ball raised above adjacent finish grades as indicated.
 - 1. Carefully remove containers so as not to damage root balls.
 - 2. Place stock on setting layer of compacted planting soil.
 - 3. Place backfill around ball in layers, tamping to settle backfill. When pit is approximately 1/2 backfilled, water thoroughly before placing remainder. Repeat watering until no more is absorbed. Water again after placing and tamping final layer of backfill.
- B. Perform planting in accordance with City of Scottsdale Standard Details and Specifications.

430.12.7 TREE AND SHRUB PRUNING

- A. Prune, thin, and shape trees and shrubs according to ANZI standard A-300

430.12.8 TREE AND SHRUB STAKING

- A. Upright Staking and Tying: Stake trees per COS Parks Department planting detail of 2- through 5-inch (50- through 125-mm) caliper. Stake trees of less than 2-inch (50-mm) caliper only as required to prevent wind tip-out. Use a minimum of 2 stakes of length required to penetrate at least 18 inches (450 mm) below bottom of backfilled excavation and to extend at least 72 inches (1800 mm) above grade. Set vertical stakes and space to avoid penetrating balls or root masses. Support trees with 2 strands of tie wire encased in hose sections at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.

430.12.9 PLANTING GROUND COVER AND PLANTS

- A. Space ground cover and plants as indicated.
- B. Space ground cover and plants not more than 48 inches (600 mm) apart.
- C. Dig holes large enough, 1 ½ times rootball size, to allow spreading of roots, and backfill with planting soil. Water thoroughly after planting.

430.12.10 MULCHING

- A. No mulch in backfill of planted areas. Mulch on surface at final grade..
- B. Granite: Apply the following average thickness of granite and finish level with adjacent finish grades. Do not place mulch against trunks or stems.
 - 1. Thickness: >2 inches (50 mm).
- C. Desert Pavement from stockpiles shall be spaced to a depth of 2 inches in all disturbed by grading and not receiving other ground treatment. The finished appearance shall be that of the surrounding natural desert. Pre-emergent shall not be applied in desert pavement areas.

430.12.11 HYDROSEEDING NEW LAWNS

- A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogenous slurry suitable for hydraulic application.

- 1. Hydroseed mixture shall contain the following:

<u>Material</u>	<u>Quantity</u>
Seed	2 lbs./1,000 S.F.
Fertilizer	As indicated by Laboratory Analysis
Wood Fiber	1500 lbs./Acre

- 2. Mix slurry with nonasphaltic tackifier.
- 3. Apply slurry uniformly to all areas to be seeded in a 2-step process. Apply first slurry application at the minimum rate of 500 lb per acre (5.5 kg per 100 sq. m) dry weight but not

less than the rate required to obtain specified seed-sowing rate. Apply slurry cover coat of fiber mulch at a rate of 1000 lb per acre (11 kg per 100 sq. m).

430.12.12 SOD (ALTERNATE NO. 2)

- A. Lay sod perpendicular to direction of slope and in a manner permitting end of pad joints to alternate. Lay sod tightly together. Do not stretch pad or overlap joints. Tamp, secure sod on slopes greater than one vertical to three horizontal. Netting scrim must be removed.
- B. Water sod immediately after installation to a depth of 1 inch below sod. After a short drying period, roll sod and smooth minor surface irregularities.

430.12.13 HYDROSEEDING/RESTORATION AREAS

**Delete Para 5 in its entirety and add this revised paragraph.*

1. After the surface treatment is completed and accepted by the Architect, seed mix shall be hydroseeded.
2. The following materials shall be combined to form a seed mulch mixture for hydroseeded applications.
 - a. Seed mix
 - b. Binder
 - c. Wood Fiber Mulch
 - d. Sufficient water to form a homogenous mixture capable of being applied by commercial hydromulching equipment.
3. Hydroseeding which is deposited on adjacent trees and shrubs, roadways, in drain ditches, on structures, and upon any area where seeding is not specified or which is placed in excessive depths on seeding areas shall be removed.
4. Seeding areas flooded or eroded as a result of irrigation shall be repaired, reseeded, and refertilized by the Contractor at his expense.
5. *Care During Construction: The Contractor shall be responsible for protecting and caring for seeded areas until final acceptance of the work and shall repair, at his expense, any damage to seeded areas caused by pedestrian or vehicular traffic, erosion due to excessive water application or other causes. A temporary aboveground irrigation system shall be designed, installed and maintained by the Contractor to germinate and establish native seeding (the use of a water truck for this purpose is not acceptable). A temporary irrigation controller capable of providing a minimum of six irrigation run cycles per day will need to be installed along with temporary remote control valves.
6. Germination: Seed germination is dependent upon a variety of factors, many of which are interacting. Temperature, light time of year, internal seed dormancy, gas exchange, and moisture are involved in seed germination.
 - a. Under favorable conditions, most non-dormant desert seeds will germinate in 7 to 10 days with constant available moisture. Watering should not be so much that it runs off or puddles. Frequent light applications of water are generally needed for good germination results. It will probably be necessary to irrigate several times per day if it is hot, windy, or the soil is well drained or sloped. Irrigation 4 to 6 times per day is not uncommon. Irrigation should be checked daily for run off and drying between cycles. Careful attention by the Contractor is required because too wet or too dry of conditions will affect germination.
 - b. Following germination of approximately 80% of the Pure Live Seed, or as accepted by the Architect, the Contractor shall request start of the Native Seed establishment period. The establishment period shall be for 90 days from the start date set by the Architect.

- c. Establishment: Establishment is considered to be after germination and before plant maturity. Water during the establishment period shall be that of gradual decrease in water application. The intent is to provide water in soil profiles where it is retained and where root growth occurs. Decreasing the water frequency allows for natural characteristics of drought tolerance to develop.
- d. The Contractor shall inspect the ground closely as soon as plants have emerged, as many seedlings are small and inconspicuous. Adjust water frequency accordingly. Inspection of plants and soil will determine the watering requirements during the establishment period. Wilting is an obvious sign of water stress. Overwatered plants may appear yellow due to nutrient deficiency or very lush with excess growth. Overwatered plants will not develop drought resistance.
- e. Water after germination should be 1 to 3 times per week on average, however, this is a variable depending on many factors. Water should be allowed to soak the soil profile as deeply as possible to encourage deep rooting. As the plants mature and develop woody tissue, the water can be decreased dramatically and temporary irrigation suspended or removed.
- f. The Contractor shall be responsible to re-apply hydromulch and seek until establishment is acceptable to the Architect based on 40% of the germinated plants surviving with no increase costs to the Contract. Maintenance of Native seed areas shall be concurrent with establishment of these areas.

430.12.14 CLEANUP AND PROTECTION

- A. During landscaping, keep pavements clean and work area in an orderly condition.
- B. Protect landscaping from damage due to landscape operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged landscape work as directed.

430.12.15 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of it off the Owner's property.

END OF SECTION

**SECTION 440
SPRINKLER IRRIGATION SYSTEM INSTALLATION**

MAG Section 440 SPRINKLER IRRIGATION SYSTEM INSTALLATION is deleted in its entirety and the following section substituted:

**SECTION 440
IRRIGATION SYSTEM INSTALLATION**

440.1 SUMMARY

- A. This Section includes piping, sprinklers, specialties, and accessories for the installation of irrigation systems.

440.2 DEFINITIONS

- A. Pipe sizes used in this Section are nominal pipe size (NPS) in inches. Tube sizes are Standard size in inches.
- B. Lateral Piping: Piping downstream from control valves to irrigation system sprinklers, emitters, devices, and drain valves. Piping is under pressure only during flow.
- C. Pressure Piping: Piping downstream from supply piping to and including control valves. Piping is under irrigation system pressure. Piping in this category includes pressure regulators, water meters, and backflow preventers, when used.
- D. Control Valve: Manual or automatic (electrically operated) valve for controlling water flow to irrigation system zone.
- E. Drain Piping: Downstream from lateral piping drain valves. Piping is not under pressure.

440.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. Location of Sprinklers and Devices: Design location is approximate. Make minor adjustments necessary to avoid plantings and obstructions such as signs and light standards.
- B. Minimum Water Coverage:
 - 1. Turf Areas: 200%, head to head coverage
 - 2. Other Planting Areas: 100 percent emitter coverage.
- C. Components and Installation: Capable of producing piping systems with the following minimum working pressure ratings except where indicated otherwise.
 - 1. Pressure, Lateral and Drain Piping: 200 psig.

440.4 SUBMITTALS

- A. General: Submit the following according to the Conditions of the Contract
- B. Material List

1. Furnish the articles, equipment, materials, or processes specified by name in the drawings and specifications. No substitution will be allowed without prior written approval by the Owner's Representative from COS Parks Department.
2. Complete material list shall be submitted prior to performing any work. Material list shall include the manufacturer, model number and description of all materials and equipment to be used.
3. Equipment or materials installed or furnished without Prior approval of the Owner's Representative from COS Parks Department may be rejected and the Contractor required to remove such materials from the site at his own expense.
4. Approval of any item, alternate or substitute indicates only that the product or products apparently meet the requirements of the drawings and specifications on the basis of the information or samples submitted.

C. Record Drawings

1. The Contractor shall dimension from two permanent points of reference (building corners, sidewalk or road intersections, etc.) the location of the following items:
 - a) connection to existing water lines.
 - b) connection to existing electrical power.
 - c) isolation valves.
 - d) routing of irrigation pressure lines (dimension maximum 100' along routing).
 - e) irrigation control valves.
 - f) routing of control wiring.
 - g) quick-coupling valves.
 - h) other related equipment as directed by the COS Parks Department Representative.

440.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Handling of PVC Pipe and Fittings: THE CONTRACTOR shall store in covered areas, not exposed to outside elements, and is cautioned to exercise care in handling, loading, unloading, and storing of PVC pipe and fittings. All PVC pipe shall be transported in a vehicle which allows the length of pipe to lie flat so as not to subject it to undue bending or concentrated external load at any point. Any section of pipe that has been dented or damaged will be discarded and, if installed, shall be replaced with undamaged piping.

440.6 GUARANTEE

- A. The guarantee for the irrigation system shall be made in accordance with the form shown below. A copy of the guarantee form shall be included in the operations and maintenance manual. The guarantee form shall be retyped onto the Contractor's letterhead and contain the following information:

GUARANTEE FOR IRRIGATION SYSTEM

We hereby guarantee that the sprinkler irrigation system we have furnished and installed is free from defects in materials and workmanship, and the work has been completed in accordance with the drawings and specifications. We agree to repair or replace any defects in material or workmanship which may develop during the period of two years from conclusion of maintenance period, and also to repair or replace any damage resulting from the repairing or replacing of such defects at no additional cost to the Owner. We shall make such repairs or replacements within 10 working days, as determined by the Owner, after receipt of written notice. In the event of our failure to make such repairs or replacements within specified time after receipt of written notice from the Owner, we

authorize the Owner to proceed to have said repairs or replacements made at our expense and we will pay the costs and charges therefore upon demand.

PROJECT: _____
LOCATION: _____

SIGNED: _____
Contractor
ADDRESS: _____

PHONE: _____

DATE OF ACCEPTANCE: _____

440.7 QUALITY ASSURANCE

- A. Comply with requirements of utility supplying water for prevention of backflow and backsiphonage.
- B. Comply with requirements of authority with jurisdiction for irrigation systems.
- C. **Installer Qualifications:** Engage an experienced Installer who has completed irrigation systems similar in material, design, and extent to that indicated for Project, and that have resulted in construction with a record of successful in-service performance.
- D. **Listing/Approval Stamp, Label, or Other Marking:** On equipment, specialties, and accessories made to specified standards.
- E. **Listing and Labeling:** Equipment, specialties, and accessories that are listed and labeled shall meet the following guidelines:
 - 1. The Terms "Listed" and "Labeled": as defined in "National Electrical Code," Article 100.
 - 2. **Listing and Labeling Agency Qualifications:** A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- F. **Product Options:** Irrigation system piping, specialties, and accessories are based on specific types, manufacturers, and models indicated. Components with equal performance characteristics produced by other manufacturers may be considered, provided deviations in dimensions, operation, and other characteristics do not change design concept or intended performance as judged by the Owner's Representative in COS Parks Department. The burden of proof of product equality is on the Contractor.

440.8 PROJECT CONDITIONS

- A. Perform site survey, research public utility records, and verify existing utility locations. Verify that irrigation system piping may be installed in compliance with original design and referenced standards.
- B. **Site Information:** Reports on subsurface condition investigations made during design of the Project are available for informational purposes only; data in reports are not intended as representations or warranties of accuracy or continuity of conditions (between soil borings).

Owner assumes no responsibility for interpretations or conclusions drawn from this information.

440.9 SEQUENCING AND SCHEDULING

- A. Maintain uninterrupted water service to building during normal working hours. Arrange for temporary water shutoff with Owner.
- B. Coordinate irrigation systems work with landscape work.

440.10 EXTRA MATERIALS

- A. Deliver extra materials to Owner. Furnish extra materials matching products installed as described below. Package them with protective covering for storage and label clearly describing contents.
 - 1. Quick Couplers: Furnish one unit of each size installed.
 - 2. Sprinklers Heads: Furnish quantity of units equal to 10 percent of amount of each type installed.
 - 3. Emitters, Drip Tube, and Devices: Furnish quantity of units equal to 10 percent of amount of each type installed.
 - 4. Valve Keys: Furnish one unit of each type key-operated, control valve installed.
 - 5. Quick-Coupler Hose Swivels: Furnish quantity of units equal to 25 percent of amount of each type quick coupler installed.
 - 6. Quick-Coupler Operating Keys: Furnish quantity of units equal to 25 percent of amount of each type quick coupler installed.
 - 7. Motorola irrigation controllers: Furnish one controller keypad per project.
 - 8. Solar irrigation controllers: Furnish one controller programming/access key per project.

440.11 MATERIALS

- A. General: Use only new materials of brands and types noted on drawings, specified herein, or approval equals.
- B. PVC Pressure Mainline Pipe and Fittings (Pressure mainline piping 3" and smaller shall be PVC Schedule 40, 4" and above shall be Class 200, *DR14, C900 with restrained bell ends per manufacturers specification*.
 - 1. *Pipe shall be made from NSF approved Type I, Grade I PVC compound conforming to ASTM specification D 2241. Piping 3" and under shall be SDR solvent weld. Piping over 3" shall be gasketed with ductile iron mechanical joints on all fittings with Megalug joint restraints.
 - 2. PVC solvent-weld fittings shall be Schedule 80, 1-2, II-I NSF approved conforming to ASTM test procedure D2467.
 - 3. Solvent cement for PVC solvent weld pipe and fittings shall be as manufactured by "Weld-On" Type 721 or approved equal. Solvent cement for Schedule 80 flex hose shall be "Weld-On" Type 795 or approved equal.
 - 4. Solvent primer for PVC solvent weld pipes and fittings shall be "all purpose primer" (purple) for PVC and PVC pipe and fittings, Type P-70.
 - 5. Installation methods of solvent cement and primer for PVC solvent-weld pipe and fittings shall be as prescribed by the manufacturer.
 - 6. All PVC pipe shall bear the following markings (pipe to be installed with markings face-up for inspection purposes):
 - a) manufacturer's name.

- b) nominal pipe size.
 - c) schedule or class.
 - d) pressure rating in psi.
 - e) National Sanitation Foundation (NSF) approval.
 - f) date of extrusion.
7. All fittings shall bear the manufacturer's name or trademark, material designation, size, applicable IPS schedule and NSF seal of approval.
 8. Thrust blocks to be installed per COS Std Detail 2643.
- C. PVC Non-Pressure Lateral Line Piping (Including Emitter Lateral Piping)
1. Non-pressure buried lateral line piping shall be PVC Class 200 solvent-weld joints for sizes 3/4 and larger. Pipe size 1/2" shall be Class 315.
 2. Pipe shall be made from NSF approved, Type I, Grade I PVC compound conforming to ASTM resin specification D2241. All pipe shall meet requirements set forth in Federal Specification PS-22-70, with an appropriate standard dimension ratio.
 3. PVC solvent weld fittings for non-pressure lateral line piping shall be Schedule 40, NSF approved conforming to ASTM test procedure D-2466.
 4. Except as noted in paragraphs 1, 2 and 3 of Section 440.11.C, all requirements for non-pressure lateral-line pipe and fittings shall be the same as for solvent-weld pressure mainline pipe and fittings as set forth in Section 440.11.B of these specifications.
- D. Brass Pipe and Fittings
1. Where indicated on the drawings, use red brass screwed pipe conforming to Federal Specification #WW-P-351.
 2. Fittings shall be red brass conforming to Federal Specification #WW-P-460.
- E. Copper Pipe and Fittings (Any pipe exposed to elements/above grade)
1. Where indicated on drawings, use copper pipe conforming to all requirements of ASTM B-88 Type K.
 2. All copper pipe shall be new, seamless copper pipe designed for underground water service plumbing purposes, etc.
- F. Isolation Gate Valves:
1. Gate Valves 2 in. and Larger:
 - a) shall be iron body, rubber encapsulated resilient wedge and shall conform to specifications of American Water Works Association Standard C509.
 - b) shall have 2 in. square operating nut with arrow cast in metal indicating direction of opening.
 - c) shall have ends compatible with pipe in which they are being installed.
 - d) shall be similar to those manufactured by Waterous Valve Mfg. Co., or approved equal.
 2. Other Isolation Valves (1-1/2" and smaller):
 - a) isolation valves 1-1/2" and smaller shall be ball valves
 - b) approved valves will be 2 piece and constructed of forged brass body and end adapter
 - c) ball shall be full port, chrome plated brass
 - d) seats and stem packing shall be virgin PTFE

- e) stem shall be brass with adjustable stem packing nut threaded to body to prevent stem leakage if lever is removed
 - f) valves shall be rated 600 psi WOG and 150 psi WSP
 - g) valves shall be equal to WATTS FBV-3
- G. Quick-Coupling Valves: Quick-coupling valves shall have a brass two-piece body designed for working pressure of 150 psi. Key size and type shall be 1" or #44.
- H. Control Wiring:
- 1. Connections between the automatic controllers and the electric control valves shall be made with direct burial copper wire AWG-UF 600 volt. Pilot wires shall be a different color wire for each automatic controller. Common wires shall be white with a different color stripe for each automatic controller. Install in accordance with valve manufacturer's specifications and wire chart. In no case shall wire size be less than #14.
 - 2. Wiring shall occupy the same trench and shall be installed along the same route as pressure supply piping. All remote control valve wiring not installed with mainline pipe shall be installed in a minimum 2" diameter schedule 40 grey electrical conduit or as approved.
 - 3. Where more than one wire is placed in a trench, the wiring shall be taped together in bundle at intervals of 10 feet. Provide loose 20" loop at all changes in direction over 30°.
 - 4. An expansion curl shall be provided within three feet of each wire connection. Expansion curl shall be of sufficient length at each splice connection at each electric control valve, so that in case of repair, the valve bonnet may be brought to the surface without disconnection of the control wires. Control wires shall be laid loosely in trench without stress or stretching of control wire conductors.
 - 5. *All splices shall be made with *Spears DS-100 Dri-Splice connectors and DS-300 sealant*. Grease filled splices are not allowed.
 - 6. Field splices between the automatic controller and electrical control valves will not be allowed without prior approval of the Owner's representative from COS Parks Department.
 - 7. All control wire under paving or structures shall be sleeved in Schedule 40 PVC Pipe. Size as required or as shown on the drawings. Minimum size shall be 2".
 - 8. Sleeve wire and pipe separately during installation.
- I. Automatic Controllers (Only Motorola Irrinet, Scorpio or solar controllers are to be installed):
- 1. 120 Volt
 - a. The controller(s) shall be installed in lockable, weather-resistant, stainless steel Lamax cabinet or approved equal per COS Std. Detail 2631, 2632, 2633 and 2634.
 - b. Final location of automatic controllers shall be approved by the Owner's Representative from COS Parks Department.
 - c. The 120-volt electrical power to the automatic controller location is shown on the drawings. The final electrical hookup shall be the responsibility of the irrigation contractor.
 - d. Location of power source for the controller to be noted on circuit breaker panel inside controller cabinet.
 - e. The programming keypad shall be supplied with Motorola Irrinet and Scorpio controllers.
 - 2. Solar
 - a. Solar controllers are only to be installed with prior written consent by the Owner's Representative from COS Parks Department.
 - b. Only DIG "Leit 4000" solar controllers are to be installed per COS Std. Details 2635-1 and 2635-2.

- c. Install wire, connectors, sealant, solenoids, adapters and security enclosure per manufacturer's instructions.
- d. Final location of solar controllers shall be approved by the Owner's Representative from COS Parks Department.
- e. Programming/access key shall be supplied with the controller.
- f. **The controller shall be secured inside the manufactures security enclosure if not installed inside the backflow preventer enclosure.*

J. Electric Control Valves:

1. Install Rainbird Series GB valves for domestic water applications and Rainbird PESB valves for reclaimed water, or approved equal.
2. All electric control valves shall be compatible with the automatic controllers.
3. All electric control valves shall have a manual flow adjustment and a brass full port ball valve installed for isolation purposes.
4. Provide and install one control valve box for each electric control valve.
5. One valve per main line tap.
6. Each control valve installed shall have a 1-1/2 inch round brass ID tag with corresponding station number of the valve stamped on it. The tag shall be attached to the valve stem with #10 gauge non-insulated copper wire.

Control Valve Boxes:

1. Minimum size to be 16" x 12" x 12" outside dimension. Provide for all valves.
2. Provide valve box with red brick pavers at corner of each portion of the valve box.
3. Boxes shall be Carson/Brooks or approved equal with locking "T" style cover supplied with stainless steel bolts.
3. Provide 6" pea gravel sump below valve body.
4. Install H-20 traffic rated boxes in high traffic areas as determined by the City of Scottsdale.
5. A H-20 traffic rated vault shall be installed for 3 inch and larger master valves.

L. Sprinkler Heads:

1. All sprinkler heads shall be of the same size, type, and deliver the same rate of precipitation with the diameter (or radius) of throw, pressure, and discharge as shown on the plans and/or specified in these special provisions.
2. Riser units shall be fabricated in accordance with COS Std. Details 2644, 2645 and 2646.
3. Swing joints for all sprinkler heads shall be the same size as the riser opening in the sprinkler body.
4. All sprinkler heads of the same type shall be of the same manufacturer.
5. Pre-fabricated swing joints and Marlex fittings will not be allowed.

M. Detectable Tape:

1. Detectable tape shall consist of 0.4mil thick solid foil core, encased in a protective plastic jacket that is resistant to alkalis, acids and other destructive elements commonly found in soil. The lamination shall have sufficient strength that the layers cannot be separated by hand. The total composite thickness shall be 4.3 mils minimum. The foil core is to be visible to ensure continuity.
2. Detectable tape shall have a minimum tensile strength of 63 lbs in the machine direction and 68 lbs in the transverse direction per three-inch strip.
3. A continuous warning message "Non-Potable", repeated every 16 to 36 inches, shall be imprinted on the tape surface. The tape shall be colored: designating the code appropriate

- to the type of line which the tape is protecting with name brand facing up to indicate location.
4. *The tape shall be installed *12 inches above the top of pipe* on all pressurized main lines.

440.12 EXECUTION

440.12.1 INSPECTION

A. Site Conditions:

1. All scaled dimensions are approximate. The Contractor shall check and verify all size dimensions and receive Owner's Representative from COS Parks Department approval prior to proceeding with work under this Section.
2. Exercise extreme care in excavating and working near existing utilities and irrigation systems. Contractor shall be responsible for damages to utilities and irrigation systems which are caused by his operation or neglect. Check existing utilities drawings for existing utility locations. Contact Owner's Representative from COS Parks Department for existing irrigation system locations (480-312-2189).
3. Coordinate installation of irrigation materials, including pipe, so there shall be no interference with utilities or other construction or difficulty in planting trees, shrubs, and ground covers.
4. The Contractor shall carefully check all grades to satisfy himself that he may safely proceed before starting work on the irrigation system.
5. No irrigation will be installed unless final grade is (+-) 1" above/below final grade as indicated on the drawings.

440.12.2 PREPARATION

A. Physical Layout:

1. Prior to installation, the Contractor shall stake out all pressure supply lines, routing and location of sprinkler heads.
2. All layout shall be approved by Owner's Representative from COS Parks Department prior to installation. Call (480)312-2189.

B. Water Supply:

1. Irrigation system shall be connected to water supply points of connection as indicated on the drawings.
2. Connections shall be made at approximate locations as shown on drawings. Contractor is responsible for minor changes caused by actual site conditions.

C. Electrical Supply:

1. Electrical connections for automatic controller shall be made to electrical points of connection as indicated on the drawings.
2. Connections shall be made at approximate locations as shown on drawings. Contractor is responsible for minor changes caused by actual site conditions.

440.12.3 INSTALLATION

- A. Trenching. Before trenching, contractor shall verify the actual final grade is at (+-) 1". Dig trenches straight and support pipe continuously on bottom of trench. Lay pipe to an even grade. Trenching excavation shall follow layout indicated on drawings and as noted. If the bottom of a pipe trench excavation is found to consist of rock, caliche, or any other material that, by reason of its hardness, cannot be excavated to give a uniform bearing surface, said rock or other material shall be removed for at least four inches (4") below the specified trench depth, and be refilled to specified trench depth with sand or similar material thoroughly tamped into place. Trenches shall be of sufficient depth to provide minimum earth coverage from finish grade as follows:
1. Pressure mainline: 24 inches
 2. Control wires: 24 inches
 3. Lateral rotary sprinkler heads: 16 inches
 4. Emitter, spray heads and bubbler laterals: 12 inches
 5. Sleeves under vehicular paving: 24 inches
 6. All other sleeves: 24 inches
 7. Electrical conduit: 24 inches
- B. Backfilling:
1. The trenches shall not be backfilled until all required tests are performed. Trenches shall be carefully backfilled in 6" lifts with the excavated materials approved for backfilling, consisting of earth, loam, sandy clay, sand, or other approved materials, free from large clods of earth or stones. Backfill shall be mechanically compacted in landscaped areas to a dry density equal to adjacent undisturbed soil in planting areas. Backfill will conform to adjacent grades without dips, sunken areas, humps or other surface irregularities.
 2. A fine granular material backfill will be initially placed on all lines to a depth of 4" over the top of the pipe. No foreign matter larger than 1/2" in size will be permitted in the initial backfill on top of pipe.
 3. All trenches will be water settled.
 4. If settlement occurs and subsequent adjustments in pipe, valves, sprinkler heads, lawn or planting, or other construction are necessary, the Contractor shall make all required adjustments without cost to the Owner.
- C. Trenching, *Sleeving and Backfill Under Paving:
1. Trenches located under areas where paving, asphaltic concrete or concrete will be installed shall be backfilled with sand (a layer four inches below the pipe and four inches above the pipe) and compacted in layers using manual or mechanical tamping devices. Trenches for piping shall be compacted to equal the compaction of the existing adjacent undisturbed soil and shall be left in a firm unyielding condition. All trenches shall be left flush with the adjoining grade. The irrigation Contractor shall set in place, cap and pressure test all piping under paving prior to the paving work.
 2. Compaction percentage of backfill material shall be based on recommendations of the Soils Report. If Soils Report is not available, compaction shall be based on MAG Section 601.
 3. Generally, piping under existing walks is done by jacking, boring or hydraulic driving, but where any cutting or breaking of existing sidewalks and/or concrete is necessary, it shall be done and replaced by the Contractor as part of the contract cost. Permission to cut or break sidewalks and/or concrete shall be obtained from the Owner's Representative. Hydraulic driving will be permitted under concrete paving provided a 24" minimum depth is maintained.
 4. Provide for a minimum cover of 24" between the top of the pipe and the bottom of the aggregate base for all pressure and non-pressure piping installed under asphaltic concrete paving.

5. Provide Schedule 40 PVC sleeves for all piping *and wiring. Sleeve shall be 2 times the diameter of the pipe being sleeved. Provide one sleeve per pipe.
 6. Install sleeves with primed and solvent welded joints to extend a minimum of 12 inches beyond all walks, curbs, pavement and hardscape. All sleeves sized to match the largest required sleeve and the ends shall be securely taped closed.
- D. Assemblies:
1. Routing of irrigation lines as indicated on the drawings is diagrammatic. Install lines and various assemblies to conform with the details shown on drawings and in accordance with the manufacturer's recommendations.
 2. Install all assemblies specified herein in accordance with respective detail. In absence of detail drawings or specifications pertaining to specific items required to complete work. Perform such work in the accordance with the best standard practice with prior approval from the Owner's representative from COS Parks Department.
 3. PVC pipe and fittings shall be thoroughly cleaned of dirt, dust and moisture before installation. Installation and solvent-welding methods shall be as recommended by the pipe and fitting manufacturer. Primer shall be used on all solvent weld joints.
 4. On PVC to metal connections, the Contractor shall work the metal connections first. Apply Teflon tape on all threaded PVC-to-metal joints. Light wrench pressure is all that is required when making the joint. Where threaded PVC connections are required, use threaded Schedule 80 TOE or TBE nipples. PVC male adaptors will not be allowed.
 5. Thrust Blocks: Concrete thrust blocks shall be installed at all end plugs, ells and tees in main lines per COS Std. Detail 2643.
- E. Line clearance. All lines shall have a minimum clearance of 12 inches from lines of other trades. Parallel lines shall not be installed directly over one another and shall have enough distance between them to facilitate bedding, compaction, and future repairs.
- F. Automatic controller. Install as per manufacturer's instructions. Remote control valves shall be connected to controller in numerical sequence as shown on the drawings. The controller shall be grounded with an 8' x 5/8" copper clad ground rod located as close as practical to the controller and connected with #10 wire minimum. Approved clamps shall be used. One ground rod per controller approved by Owner's representative from COS Parks Department.
- G. High-voltage Wiring for Automatic Controller
1. 120-volt power connection to the automatic controller shall be provided by the Irrigation Contractor.
 2. All electrical work shall conform to local codes, ordinances, and governing authorities having jurisdiction.
- H. Remote control valves. Install where shown on drawings and details. When grouped together, allow at least 18" between valves. Install each remote control valve in a separate valve box. Locate adjacent to walks or curbs where possible. Identify each valve with a permanent marker, tied to stem, with controller and station identification marked. Provide one mainline tap for each lateral line valve. For sports field applications, valves are to be located outside field of play. Remote control valves are not to be located within hardscape.
- I. Flushing of System:
1. After all new irrigation pipe lines and risers are in place and connected, all necessary diversion work has been completed, and prior to installation of sprinkler heads and

emitters, the control valves shall be opened and a full head of water used to flush out the system.

2. Sprinkler heads shall be installed only after flushing of the system has been accomplished

J. Sprinkler Heads:

1. Install the sprinkler heads as designated on the drawings. Sprinkler heads to be installed in this work shall be as shown on the drawings.
2. Spacing of heads shall not exceed the maximum indicated on the drawings. In no case shall the spacing exceed the maximum recommended by the manufacturer.
3. Ensure 200% coverage, head to head.

440.12.4 TEMPORARY REPAIRS

- A. The Owner reserves the right to make temporary repairs as necessary to keep the sprinkler system equipment in operating condition. The exercise of this right by the Owner shall not relieve the Contractor of his responsibilities under the terms of the guarantee as herein specified.

440.12.5 EXISTING TREES

- A. Whenever possible, excavation within the drip line or under foliage canopy of existing trees is to be avoided. Where it is necessary to excavate adjacent to existing trees, the Contractor shall use all possible care to avoid injury to trees and tree roots. Excavation in areas where it is reasonably anticipated there to be roots two inches and larger in diameter shall be done by hand. All roots two inches and larger in diameter, except those directly in the path of pipe or conduit, shall be tunneled under and any roots exposed during tunneling shall be covered with burlap to prevent damage and excessive dehydration. Where trenching machinery is operated close to trees having roots smaller than two inches in diameter, the wall of the trench adjacent to the tree shall have the severed roots trimmed by hand, making clean cuts to the severed root ends. Trenches adjacent to trees should be closed within 24 hours, and where this is not possible, the side of the trench adjacent to the tree shall be kept shaded with burlap until the trench is closed. All burlap used for shading and protection shall be removed from trenches prior to closure.

440.12.6 FIELD QUALITY CONTROL

A. Adjustment of the System:

1. The Contractor shall flush and adjust all sprinkler heads for optimum performance and to prevent overspray onto walks, roadways, and buildings as much as possible.
2. If it is determined that adjustments in the irrigation equipment will provide proper and more adequate coverage, the Contractor shall make such adjustments prior to planting. Adjustments may also include changes in nozzle sizes and degrees of arc as required. Such changes shall be approved in advance by the Owner's Representative from COS Parks Department.
3. Sprinkler, emitter and bubbler height adjustment by the Contractor shall be accomplished within 10 days after notification by Owner Representative from COS Parks Department.
4. All sprinkler heads shall be set perpendicular to finished grades unless otherwise designated on the plans. On slopes, heads shall be angled for optimum coverage.
5. Owner's Representative from COS Parks Department to approve all head relocations and reserves the right to request Contractor to make minor adjustments to head or emitter placement or nozzle selection at no cost to the Owner.

B. Testing of Irrigation System:

1. The Contractor shall request the presence of the Owner's Representative from COS Parks Department at least 48 hours in advance of testing. Call (480) 312-2189.
2. Test all pressure lines under hydrostatic pressure of 150 lbs./sq. in. and prove watertight. ***NOTE:** Testing of pressure main lines shall occur prior to installation of electric control valves. *Prior to the installation of the electric control valves, all mainlines shall be flushed.*
3. All piping under paved areas shall be tested under hydrostatic pressure of 150 lbs./sq. in. and proved watertight prior to paving.
4. Sustain pressure in lines for not less than two hours. Pipe sections shall be center loaded and all couplings shall be exposed. Before testing, the line shall have been filled with water for at least four (4) hours and provisions made for thoroughly bleeding the line of air.
5. All hydrostatic tests shall be made only in the presence of the Owner's Representative from COS Parks Department. No pipe shall be backfilled until it has been inspected, tested and approved in writing.
6. Contractor shall furnish necessary force pump and all other test equipment.
7. When the irrigation system is completed, perform a coverage test in the presence of the Owner's Representative from COS Parks Department to determine if the water coverage for planting areas is complete and adequate. Furnish all materials and perform all work required to correct any inadequacies of coverage due to deviations from plans or where the system has been willfully installed as indicated on the drawings when it is obviously inadequate without bringing this to the attention of the Owner's Representative from COS Parks Department. This test shall be accomplished before any ground cover is planted.
8. Upon completion of each phase of work, the entire system shall be tested and adjusted to meet site requirements.

440.12.7 MAINTENANCE

- A. The entire sprinkler irrigation system shall be under full automatic operation for a period of seven days with all malfunctions and leaks corrected prior to any planting.
- B. The Owner's Representative from COS Parks Department reserves the right to waive or shorten the operation period.

440.12.8 CLEANUP

- A. Cleanup shall be made as each portion of work progresses. Refuse and excess dirt shall be removed from the site, all walks and paving shall be broomed or washed down, and any damage sustained on the work of others shall be repaired at the Contractor's expense to the original conditions acceptable to the Owner's Representative from COS Parks Department.

440.12.9 FINAL OBSERVATION PRIOR TO ACCEPTANCE

- A. The Contractor shall operate each system in its entirety for the Owner's Representative from COS Parks Department at the time of final observation. Any items deemed not acceptable shall be reworked to the complete satisfaction of the Owner's Representative.
- B. The contractor shall show evidence to the Owner's Representative from COS Parks Department that the Owner has received all accessories, charts, record drawings, and equipment as required before final observation can occur.

440.12.10 OBSERVATION SCHEDULE

- A. Contractor shall be responsible for notifying the Owner's Representative from COS Parks Department in advance for the following observations according to the time indicated:
1. Pre-job conference – Seven (7) days.
 2. Pressure supply line installation and testing – 48 hours.
 3. Automatic controller installation – 48 hours.
 4. Control wire *and valve installation – 48 hours.
 5. Lateral line and sprinkler / emitter installation – 48 hours.
 6. Coverage test – 48 hours.
 7. Final observation – Seven (7) days.
 8. Emitter and distribution line placement – 48 hours.
 9. Emitter operation – 48 hours.
 10. Sleeving Installation – 48 hours.
- B. When inspections have been conducted by other than the Owner's Representative from COS Parks Department, show evidence **in writing** of when and by whom these inspections were made.

END OF SECTION

PART 600 - WATER AND SEWER

**SECTION 601
TRENCH EXCAVATION, BACKFILLING AND COMPACTION**

601.1 DESCRIPTION: *Add the following paragraph:*

All trench bedding and backfill shall be in accordance with COS Standard Detail 2201.

601.2.3 Trench Grade: *Modify the second sentence of the first paragraph to read as follows (Modified text is highlighted):*

On water main projects, elevation stakes will be furnished for **waterlines 12 inches or more in diameter**.

Modify the first sentence of the second paragraph to read as follows (Modified text is highlighted):

For all sewer pipe 8 inches or greater in diameter and **water pipe 12 inches or greater in diameter**, the Contractor shall excavate for and provide an initial granular bedding at least four inches thick or 1/12 the O.D. of the pipe whichever is greater.

601.2.5 Overexcavation: *Add the following paragraph:*

For PVC and HDPE sewer pipe trenches over-excavated in excess of 0.30 feet, Class I, II, or III material shall be provided as a foundation (see ASTM D-2321). This foundation material shall be compacted within a range of +2 percent to -4 percent of optimum moisture content to a minimum 90 percent density.

Add the following subsections:

601.3.6 Utility/Water Line Crossings: Locator Strips and ABC Slurry

Primary electrical conductors, natural gas, or fiber optic telephone lines shall not be allowed to cross above water lines unless approved in writing by the COS Water Resources Department.

If a primary electrical conductor, natural gas, or fiber optic telephone line is allowed to cross above a water line, then ABC slurry and double utility locator strips shall be provided.

The required utility locator strips shall be a minimum three (3) inch wide, color coded for the appropriate utility, and shall be laid in a criss-crossing pattern along both the water line and the over-crossing utility alignments. The horizontal placement of the utility locator strips shall be along the centerline of the alignments. The vertical placement of the utility locator strips shall be at an elevation one (1) foot above the over-crossing electrical/natural gas/fiber optic line. The utility locator strips shall extend six (6) feet on both sides of the point of intersection for both the water line and the over-crossing utility line. The requirement of placing criss-crossing locator strips may be waived by the COS Water Resources Department if locator strip placement requires trenching in pre-existing pavement.

The required ABC slurry mix shall be placed in the over-crossing utility trench from the top of the shading/embedment zone (maximum of 12 inches above the uppermost conduit) and shall have a minimum thickness of one (1) foot. The ABC slurry shall extend six (6) feet on both sides of the point of intersection with the water line. This requirement may be waived by the COS Water Resources Department if the over-crossing line is being placed by means of boring. The ABC slurry mix shall meet the requirements contained in COS Supplemental Specification Section 728.

601.3.7 Water Lines: Marking Tape

Pipe marking tape shall be installed over all water lines. Pipe marking tape shall be a minimum 4.0 mils thick, inert polyethylene plastic that is impervious to all known alkalis, acids, chemical reagents and solvents likely to be encountered in the soil. For pipe diameter 24 inches or less, the tape width shall be 6 inches or greater. For pipe diameter larger than 24 inches, the tape width shall be 12 inches or greater. Marking tape shall be blue in color with the following message printed thereon: "POTABLE WATER LINE". The tape message shall be imprinted continuously over the entire length in permanent black lettering with the message spacing not to exceed 18 inches. The lettering shall be a minimum 1 1/2 inches high. The spacing between the individual words of the message shall not exceed three inches. Marking tape shall be buried 24 inches below the surface over the center of the pipe. The backfill shall be sufficiently leveled so that the tape is installed on a flat surface. The tape shall be centered in the trench with the printed side up.

601.4.2 Bedding: *Modify the first sentence of the first paragraph to read as follows (Modified text is highlighted):*

Bedding shall be **Select Material Type B or Aggregate Base as per MAG Table 702**, or granular material containing no pieces larger than 1-1/2 inches and free of broken concrete, broken or recycled pavement, wood or other deleterious material.

Modify the first two sentences of the third paragraph to read as follows (Modified text is highlighted):

Where mechanical compaction is used, the moisture content shall be **within a range of +2 percent to -4 percent of the optimum moisture content prior to placing the material in the trench**. The first lift shall be 8 inches or 2/3 (**two-thirds**) of the distance to the springline whichever is greater.

601.4.4 Compaction Densities: *Add the following paragraph:*

For sewer lines, compaction tests in both the bedding zone and the backfill zone shall be conducted at intervals specified by the COS Field Engineering Manager or designated representative.

601.4.5 Compaction Methods: *Add the following paragraph:*

For all PVC and HDPE sewer pipe, alignment and initial consolidation of bedding up to the springline of the pipe shall be accomplished and approved by the inspector before succeeding layers are placed. Final compaction may be accomplished as part of the compaction of the succeeding layer with the approval of the COS Field Engineering Manager or designated representative.

601.4.6 Specifications for Granular Material: *Modify the first sentence of this paragraph to read as follows (Modified text is highlighted):*

For purposes of this specification, granular material shall mean material for which the sum of the plasticity index and the percent of the material passing a No. 200 sieve shall not exceed 23. **For PVC sewer pipe (SDR 35) only, the percent of the material passing a No. 200 sieve may exceed 12 percent only when the plasticity index does not exceed 6.**

**SECTION 603
INSTALLATION OF HIGH DENSITY
POLYETHYLENE PIPE**

603.1 DESCRIPTION: *Add the following paragraph:*

Written approval for the use of HDPE pipe shall be obtained from the Transportation Planning Division for storm sewers and culverts, and from the Water Resources Department for sanitary sewer installations.

603.2 EXCAVATION AND COVER: *Add the following paragraph:*

The minimum cover for HDPE pipe shall be one (1) feet for all pipe diameters to the top of pavement. Trench excavation shall provide for a minimum of twelve (12) inches of clearance on either side of the pipe.

603.4.2 Bedding: *Replace this section in its entirety with the following:*

Course aggregate, crushed rock, or granular native soil may be used for bedding and backfill of HDPE pipe and shall comply with MAG Section 701 and MAG Table 702. If native soil is to be used, the Contractor shall provide at least three gradation tests per 1,000 linear foot of trench from the City's material testing company which illustrates compliance with the gradation requirements.

Compaction of bedding backfill may be performed by water consolidation as provided in MAG 601.4.5. The minimum compaction requirements shall be as provided in MAG Table 601.2. Care shall be taken to avoid pipe flotation.

Compacted backfill shall be placed in eight (8) inch lifts or less, compacted around the pipe with vibratory compactors. Lift placement and compaction shall be repeated until enough material is placed and compacted to provide a minimum of one (1) foot of cover over the top of the pipe.

603.5.4 Installing Pipe: *Add the following paragraph:*

Whenever corrugated HDPE pipe is interfaced with concrete or concrete structures, a heavy coat of "Noah's" pitch shall be applied around the pipe to be in contact with the concrete. "Ram-Nek", or approved equal, shall then be wrapped around the pipe over the "Noah's" pitch prior to placement of the concrete. A waterstop gasket may be used only after written approval is obtained from the City.

Add the following subsection:

603.5.6 Deflection Test and Inspection: MAG Subsection 615.10 (C) and (D) shall also apply to HDPE storm drain installations. MAG Subsection 615.10 (D) may be waived for storm drain installations only if the Engineer determines that a visual inspection is permissible.

The maximum permitted HDPE pipe deflection shall be five (5) percent of the nominal pipe diameter. Any pipe found to exceed the deflection standard shall be removed or repaired. If required by the Engineer, the Contractor shall mandrel all installed HDPE pipe in the presence of a City Inspector, or may submit an alternate deflection measurement technique to Transportation Planning for approval. The Contractor shall perform another mandrel test on the removed or repaired section. Testing results and certification, if required, shall be provided to the Transportation Planning Department in the case of storm sewers or culvert installations.

**SECTION 610
WATER LINE CONSTRUCTION**

610.3 MATERIALS: *Add the following paragraph:*

Polyethylene and polybutylene material shall not be used in any water system installation.

610.4 CONSTRUCTION METHODS: *Add the following paragraph:*

All horizontal water line deflections shall be marked with electronic locators which shall be self-leveling type, operate at a frequency of 145.7 kHz and be capable of detection to a depth of 4 feet.

610.5.1 General: *Add the following sentence:*

At a minimum, corrosion protection shall be provided using appropriately color-coded polyethylene protection wrap per AWWA C105 on all ductile iron pipe. Color code shall be as follows: purple for non-potable water, green for sewer, and blue for potable water.

610.6 VALVES: *Add the following paragraphs:*

Water line air release and vacuum valves (blow-off valves) shall not be constructed in driveways, sidewalks, washes or retention/detention areas unless approved by the City.

All valves shall be installed with appropriate sized debris caps. The handle color shall be blue for potable and purple for non-potable to indicate type of line. Acceptable manufacturer is SW Services in Phoenix, or approved equal.

610.7 MANHOLES AND VAULTS: *Add new subsection.*

Construction shall consist of furnishing all materials and constructing manholes or vaults complete and in place, as detailed, including foundation walls, access steps, frames, covers, and any incidentals thereto, at the location shown on the plans.

Vaults shall be constructed of reinforced concrete conforming to MAG Section 725 and of concrete pipe conforming to ASTM C-76, Wall A or B. Vaults shall be kept moist 7 days before backfilling.

Manholes shall be constructed to conform to the requirements of MAG Section 825, as supplemented by COS Section 625, and the COS Standard Details, except as modified below.

Water manhole frames shall be "Pamrex" as manufactured by Saint-Gobain or an approved equal. Frames and covers shall be manufactured from ductile iron and be capable of withstanding a test load of 80,000 pounds. Covers shall be hinged and incorporate a 90 degree blocking system to prevent accidental closure, be one man operable using standard tools, and come equipped with a locking mechanism. Frames shall be circular, incorporate a sealing ring, and be available in a 24-inch or 32-inch opening as specified on the plans. The flange shall incorporate bedding slots and bolt holes. All components shall be black coated. The cover shall be stamped "Water".

610.8 FIRE HYDRANTS: *Add the following paragraph:*

Fire hydrants shall not be constructed in driveways, sidewalks, washes, or retention/detention areas unless approved by the City.

Minimum distance allowable between the centerline of the lowest nozzle and ground line is 18 inches.

Installation shall be in accordance with MAG Standard Detail 360 and testing shall be according to AWWA Standards.

The hydrant shall be suitable for installation in a 42-inch depth of trench (3.5 foot bury hydrant). The use of Gradelok connector pipe as manufactured by Assured Flow Sales, Inc. or approved equal shall be required when main depths exceed 42 inches. Not more than one 6-inch fire hydrant extension shall be installed for any hydrant. Should the ground line adjacent to an existing fire hydrant change due to landscaping and/or construction, the Contractor shall be responsible for adjusting the hydrant to meet the specifications outlined in MAG Standard Detail 360. Adjustments shall not exceed one 6-inch extension on an existing hydrant. For adjustments in excess of 6 inches, the use of Gradelok connector pipe or approved equal shall be required. In applications of excessive depth, vertical entry hydrants approved by Water Operations are acceptable.

610.9 CONNECTION TO EXISTING MAINS: *Add the following paragraphs:*

COS Inspection Services (telephone (480)312-5750) shall be contacted 48 hours prior to all water system shutdowns. The Contractor shall have all materials and equipment necessary to do the work at the jobsite prior to the shutdown occurring. The Contractor shall be responsible for providing a written notice of the proposed shutdown to all affected water customers a minimum of 24 hours in advance except in an emergency.

Ties into existing PVC water mains shall be accomplished by installing a stainless steel tapping sleeve and valve. Cast iron tees may be used with City approval.

All valve boxes shall be adjustable cast iron with pentagonally-bolted lids per MAG Standard Detail No. 391-1-C and COS Standard Detail 2270 unless specified otherwise on the plans.

Stainless steel tapping sleeves shall be 360 degree, full circle tapping sleeves and shall conform to COS Supplemental Specification Section 630.

610.10 METER SERVICE CONNECTIONS: *Add the following paragraphs:*

Water meters shall not be constructed in driveways sidewalks, washes or retention/detention areas unless approved by the City.

All water service lines constructed under existing pavement shall be installed by mechanical/pneumatic underground boring unless otherwise approved by the COS Transportation Maintenance Director. Water boring is not allowed for construction of water service lines under existing pavement.

Polyethylene and polybutylene material shall not be used in any water system installation.

Pack joint meter stops and corp stops shall be used exclusively.

610.14 TESTING: *Add the following paragraph:*

All ductile iron pipe and concrete cylinder pipe installations shall be corrosion protected. Final acceptance of the work shall not be given until entire system continuity/protection is shown to exist and is accepted by the COS Water Resources Department.

Change the second sentence of Paragraph (A) to the following (new text is highlighted in bold italics):

(A) Pressure Tests: Water lines, including all fittings and connections to the water mains shall be tested for watertightness by subjecting each section to pressure test, measured at the lowest end of the section under test. ***The test pressure shall be at least 125% of the design pressure, or 200 psi, whichever is greater.***

Add the following subsection:

610.14.1 Electrolysis Test Stations:

The Contractor shall furnish all materials and perform all work for installing a corrosion monitoring system for all buried concrete cylinder pipelines.

(A) Materials and Construction Methods:

Four-wire insulating test stations shall be installed at all insulating fittings where shown on the plans, with two wires installed on each side of the insulating fittings.

Wires for corrosion monitoring points shall be minimum AWG No. 8 insulated with HMW/PE insulation. Wires shall be sized such that they may be used for any and all of the field tests specified.

Thermite weld connections, as shown, specified or directed by the Engineer, shall be made with thermite weld kits specifically designed by the manufacturer for such applications. Thermite welds shall be a maximum 15-gram charge.

As an option to thermite weld connections, E70XX electrode welds may be used. The E70XX electrode weld shall be installed in accordance with the pipe manufacturer's instructions.

When connecting test lead conductors by the use of thermite weld equipment to concrete cylinder pipe or steel pipe, the pipe surface shall be cleaned by scraping, filing, or wire brushing to produce a clean, bright surface. The thermite weld shall be installed in accordance with the manufacturer's instructions and as indicated. Upon completion of the thermite weld, but before the application of the cement-mortar coating, the Contractor shall strike the weld with two sharp blows from a brass hammer. All defective welds shall be replaced by the Contractor.

Valve boxes shall be Brooks 1-RT, or equal, with cast iron cover marked "C.P. Test" and shall be provided with pentagonally bolted lids.

(B) Field Tests:

(1) Field tests shall be performed by the Contractor as required to determine the following:

- Pipeline electrical conductivity.
- Effectiveness of insulating joints.
- Metering point integrity.
- Presence of stray D/C current on the pipeline.
- Initial pipe-to-soil potential.

All test data shall be submitted for approval.

(2) The buried pipelines shall be tested for electrical continuity and dielectric isolation from other structures and pipelines after all connections have been made. The testing procedure shall be as follows:

(a) The test shall be conducted by measuring response of the pipe to the application of cathodic protection test current with an auxiliary ground at a minimum of 10 feet from the pipeline. The positive terminal of the portable test rectifier unit shall be connected to the auxiliary ground. The negative terminal shall be connected to the pipeline at a test station. The test rectifier shall be energized with A/C power and shall be adjusted to provide sufficient D/C current to obtain adequate pipe-to-soil potential shifts along the pipeline for performing the tests. A current interrupter shall be inserted in the test rectifier circuit so that the rectifier is turned "OFF" and "ON" automatically. A set of "NATIVE" potentials shall be obtained prior to the application of the test current.

(b) Measurements of the pipe-to-soil potential shall be made with the test current turned both off and on. The pipe-to-soil potential shall be measured at representative locations along the full lengths of the pipeline to be tested. In addition, potential measurements shall be taken across the dielectric insulating fittings. The pipe-to-soil potentials shall be measured with a potentiometer/voltmeter circuit of a multi-combination meter and with respect to portable copper sulfate reference electrode placed at grade. Contact to the pipe for obtaining potential measurements shall be made at test stations previously installed during construction for that purpose.

(c) If the pipe-to-soil potential is made more positive by application of the test current, electrical discontinuity of the pipeline is indicated between that point and the point at which the test rectifier negative connection was made.

(d) If the pipe-to-soil potential is made more negative by application of the test current, electrical continuity of the pipeline is indicated between that point and the point at which the test rectifier negative connection was made. The magnitude of negative shifts will be analyzed to determine if the degree of electrical continuity is consistent with the specified requirements for joint bonding.

(e) Dielectric isolation across insulating fittings shall be indicated by the pipe-to-soil being more positive or insignificant differences in the pipe-to-soil potentials across the fittings with the application of the test current.

(f) Multiple test set-ups will be necessary so that the full length of the pipeline is demonstrated to be electrically continuous and dielectrically isolated from other structures.

610.18 MEASUREMENT AND PAYMENT: *Add the following paragraph:*

(I) Measurement and payment for electrolysis test stations shall be per each test station as furnished and installed per the plans, including all excavation, backfill, wiring, field testing, valve box and cover, and all appurtenant work.

**SECTION 611
DISINFECTING WATER MAINS**

611.7 METHODS OF APPLYING CHLORINE: *Add the following paragraph:*

Dry powdered calcium-hypochlorite compounds shall not be placed within pipelines during construction.

611.15 FINAL FLUSHING, SAMPLING AND TESTING: *Delete the second paragraph and replace it with the following paragraph:*

Notify the COS Inspection Services Representative (telephone (480)312-5750) when a water system is ready to have bacterial samples taken to determine whether disinfection has been adequate. The samples are collected by the COS Water and Wastewater Quality Division on Mondays and Wednesdays only.

**SECTION 615
SEWER LINE CONSTRUCTION**

Add the following subsection:

615.1.1 Lining for Ductile Iron Sewer Pipe: All ductile iron sanitary sewer pipe shall have an appropriate liner installed based on the sewer application. Cement mortar and coal tar asphalt will not be accepted as an appropriate liner material.

A test report verifying the following properties and a certification of the test results must be submitted and approved by Water Resources before installation.

(A) A permeability rating of 0.00 when tested according to method A of ASTM E-96-66, Procedure A with a test duration of thirty (30) days.

(B) The following test must be run on coupons from factory lined ductile iron pipe:

(1) ASTM B-117 Salt Spray (scribed panel): Results to equal 0.0 undercutting after one year.

(2) ASTM G-95 Cathodic Disbondment 1.5 volts at 77 degrees Fahrenheit: Results to equal no more than 0.5mm undercutting after thirty (30) days.

(3) Immersion Testing rated using ASTM D-714-87:

(a) 20% Sulfuric Acid - No effect after one year.

(b) 25% Sodium Hydroxide - No effect after one year.

(c) 160 Degree Fahrenheit Distilled Water - No effect after one year.

(d) 120 Degree Tap Water (scribed panel) - 0.0 undercutting after one year with no effect.

615.2 TRENCHING: *Add the following paragraph:*

Separate inspections by the City may be required for trench bottom preparation and for haunch consolidation.

615.6 SANITARY SEWER SERVICE TAPS: *Add the following paragraphs:*

* All taps shall be the 45-degree wye type. All sanitary sewer service taps constructed with a wye, shall be marked with electronic locators. Electronic ball locators shall be four-inch diameter, self-leveling type, operating at a frequency of 121.6 kHz and be capable of detection to a depth of 5 feet. Color of the electronic locator shall be green.

The sealed end of sanitary sewer taps at property lines shall be marked with a 2 inch x 4 inch x 30 inch long wooden stake or metal stud. The stake shall be driven firmly into the ground exposing a minimum of 12 inches of the stake. The stake shall be labeled to indicate "sewer tap".

615.9 BACKFILLING: *Add the following paragraph:*

Completed sanitary sewer lines shall not be backfilled until inspected and approved by the COS Field Engineering Manager or designed representative.

615.10 TESTING: *Delete the text of subsection (D) Closed Circuit T.V. Inspection, and insert the following:*

All new sewer lines shall receive a final inspection by video viewing and taping. Defects will require correction and reinspection, the second and any subsequent video-taped inspections shall be at the contractors expense. All video tapes become the property of the City of Scottsdale Water Resources Department, Operations Division.

Add the following subsection:

(E) Sewer Force Main Testing:

Prior to issuance of Certificate to Operate, all force mains shall be pressure tested.

Preparatory to testing, the section of the pipeline to be tested shall be filled with water and placed under a slight pressure for at least forty-eight (48) hours. The pipeline shall then be brought up to one hundred fifty (150) psi or to one hundred twenty-five (125) percent of maximum system operating pressure, whichever is greater, and shall be maintained on the section under test for a period of not less than four (4) hours with no (0) leakage.

Add the following Section:

**SECTION 619
PRECAST REINFORCED CONCRETE BOX SECTIONS**

619.1 GENERAL:

This specification covers the furnishing and placing of precast reinforced concrete box sections for use in the conveyance of storm waters under low hydrostatic heads.

619.2 MATERIALS:

(A) Precast reinforced concrete box sections shall conform to the specifications of AASHTO Designation M259 or M273, as controlled by the amount of cover indicated on the plans.

(B) Mortar shall consist of one part portland cement and two parts sand, by volume. The quantity of water in the mixture shall be sufficient to produce a soft workable mortar, but in no case shall exceed a water-cement ratio of 0.53. Sand shall conform to MAG Section 701 and portland cement shall conform to MAG Section 725.

(C) Preformed joint material shall conform to the requirements of AASHTO Designation M 198, Type B.

(D) Bedding material shall conform to the requirements of MAG Section 702, aggregate base course material.

619.3 SHOP DRAWINGS:

The Contractor shall submit shop drawings of any specially fabricated sections for the Engineer to review and approve prior to the start of any work.

619.4 SHIPPING AND HANDLING:

Concrete boxes shall be carefully handled during loading, transport, unloading and laying. Boxes which show defects due to handling shall be rejected at the site of installation regardless of any prior acceptance. Any box which is cracked, chipped, spalled or damaged shall be removed from the work site.

619.5 CONSTRUCTION METHODS:

(A) Excavation and backfill: Shall be in accordance with MAG Section 206 except as modified herein.

A two (2) inch minimum granular bedding material shall be constructed to provide uniform support for the full length and width of each section. Granular material shall be aggregate base course meeting the specifications of MAG Section 702.2.2.

Structural backfill shall not be placed until the installation has been inspected by the Engineer and approved for backfilling.

(B) Laying of sections: Placing of the sections shall begin at the downstream end of the line. The grooved ends of the box segments shall be in full contact with the prepared bedding. The box segments shall be checked of for grade and alignment at the time of joining the sections. Box segments shall be joined such that the inside faces are flush and even.

Lift holes shall be plugged with mortar and finished smooth and flush with the inside face of the box section.

(C) Joints: Unless otherwise specified on the plans the Contractor shall have the following options for making joints:

(1) Cold applied preformed gaskets: Joints for precast boxes shall be sealed with a flexible, watertight, preformed joint material. Installation shall be per the manufacturer's instructions and recommendations. The joint material shall be protected by a suitable wrapper so designed that when removed at the proper time, the material will maintain its integrity. The size and application of the preformed joint material shall be per the precast box manufacturer's recommendations and shall be sufficient to obtain a visible squeeze out.

(2) Mortar joints: The section ends shall be cleaned and wetted before making the joint. The lower half of the bell or groove and the upper half of the tongue or spigot shall be plastered with mortar. Maximum allowable gap tolerance between joints shall be three-fourths (3/4) inch. Any resulting annular space shall be filled with mortar and finished flush with the inside faces of the box.

Exterior joints shall be beaded semi-circular one (1) inch to each side of the tongue and groove joint or beveled to form a forty-five (45) degree joint between the outer edge of the bell and spigot.

Mortar joints shall be cured by keeping them wet for at least forty-eight (48) hours or until the exterior joints are backfilled, whichever comes first. No joints shall be constructed when the temperature is at or below forty (40) degrees F. Mortared joints shall be protected against freezing for at least forty-eight (48) hours.

(D) Alignment and grade: Each precast section shall be checked for alignment and grade. The interior of the boxes shall be kept free of debris and foreign material as the box laying progresses and shall be left clean at the completion of the work.

Any box which is not in true alignment or on grade, or shows signs of undue settlement or damage after setting shall be taken up and re-laid at the Contractor's expense.

Horizontal or vertical joint deflection shall not exceed the manufacturer's recommendations. Changes in alignment, in excess of those obtainable by allowable joint deflections, shall be made by special manufactured beveled sections or concrete junction structures as detailed on the plans.

619.5.1 Repair

Fine cracks and checks on the surface of a member which do not extend to the plane of the nearest reinforcement shall not be cause for rejection unless they are numerous and extensive as determined solely by the Engineer. Cracks which extend into the plane of reinforcement, but are otherwise acceptable, may be repaired by a method acceptable to the Engineer.

619.6 MEASUREMENT:

Precast reinforced concrete box sections shall be measured in number of linear feet horizontally along the box centerline from end to end.

619.8 PAYMENT:

Payment will be made at the contract unit price bid per linear foot to the nearest foot for each size of precast reinforced concrete box installed, which shall be full compensation for the item complete and in place as described herein and on the plans.

**SECTION 620
CAST-IN-PLACE CONCRETE PIPE**

MAG Section 620 CAST-IN-PLACE CONCRETE PIPE is deleted in its entirety and the following section substituted:

**SECTION 620
CAST-IN-PLACE CONCRETE PIPE**

620.1 GENERAL:

This specification covers cast-in-place non-reinforced concrete pipe (CIPP) intended for use as storm sewers or irrigation lines. CIPP is conduit made of portland cement concrete cast monolithically in a properly prepared trench, using equipment specifically designed for this purpose. The type of equipment to be used by the Contractor must be approved by the Engineer and the Contractor may be required to furnish evidence of the successful use of this equipment on prior work. CIPP will be placed only:

- (A) By experienced operators. The Engineer will be the sole judge as to experience level.
- (B) In the presence of the Engineer or designated representative.
- (C) In ground capable of standing unsupported from the bottom of the trench to the top of the pipe without sloughing.
- (D) In fill when it can be demonstrated to the satisfaction of the Engineer that the fill will adequately support the pipe.
- (E) When designated as an allowable storm sewer pipe material in the project specifications. This designation is no warranty, expressed or implied, that conditions will be suitable for the use of CIPP. Any costs incurred and/or time required to provide suitable conditions or to substitute an alternate pipe acceptable to the Engineer, in whole or in part, shall be the responsibility of the Contractor. CIPP will not be placed at locations where other materials have been specifically shown or noted on the plans.

620.2 MATERIALS:

620.2.1 Cement shall be ASTM C-150, Type II, low alkali as per MAG Section 725.

620.2.2 Sand aggregate used for concrete and mortar shall conform to MAG Section 701. Maximum size of the aggregate shall not be greater than 1/3 of the minimum wall thickness up to and including a wall thickness of 4-1/2 inches (114 mm). The maximum aggregate size is 1-1/2 inches (38 mm).

620.2.3 Water used for concrete and for curing the pipe shall be as per MAG Section 725.

620.2.4 Concrete shall be Class A in accordance with MAG Section 725. Slump shall be the minimum required for satisfactory placement of the concrete by the equipment used by the Contractor. The slump shall not exceed 3 inches (75 mm).

620.2.5 Bonding mortar shall consist of two (2) or more parts of cement to three (3) parts of sand by volume.

620.3 CONSTRUCTION METHODS:

620.3.1 Excavation: The trench will be neatly excavated with vertical sides and semi-circular bottom. The trench shall be shaped to form the bottom outside of the pipe on the alignment and to the grades specified in the plans. Departure from and return to the established grade for the finished trench and the invert of the installed pipe shall not exceed 1 inch (25 mm) per 10 linear feet (3 M) with a maximum allowable departure of 0.10 feet (30 mm). Departure from and return to specified alignment for the trench and pipe shall not exceed the allowable tolerances specified for the grade. The bottom of the trench, hereinafter known as the trench form, will be shaped to provide full, firm, and uniform support by undisturbed earth or compacted fill for at least the bottom 210 degrees of the pipe. Density of the fill shall be at least five percent (5%) greater than the natural in place soil, but in no case less than 85 percent (85%) when tested in accordance with AASHTO T-99, Method A and T-191 or ASTM D-2922 and D-3017.

When it is necessary to install the pipe in rocky areas, the rock will be removed and replaced with suitable fill material compacted to proper density. The rock will be over-excavated to leave a 6-inch (150 mm) minimum compacted soil cushion between the rock and the pipe. For construction accuracy, areas left void by rock removal will be completely filled with compacted material, then trenched for the pipe as though natural ground.

If the rock below the pipe subgrade is fractured or fragmented or if it consists of large cobblestones or boulders, the replacement fill material will be carefully selected to insure that it is of such gradation that it will not be removed downward by fluctuation of the water table. In no case will expansive soils be used for fill. A similar procedure of over-excavation, backfill, compaction, and retrenching will be used where sloughing sand or where soft or spongy soil conditions are encountered. When expansive clays are encountered, they will be thoroughly moistened by ponding, to completely expand the soil, and the moisture maintained until the concrete is placed. The Contractor may substitute non-reinforced or reinforced concrete pipe for CIPP in these unsuitable areas. There will be no additional payment for this substitution.

Excavated trench shall be checked for compliance with requirements for grade and alignment prior to placement of concrete. The Contractor shall submit proposed method of grade and alignment control and checking of same for conformance with specifications to the Engineer for approval prior to start of work. The Contractor shall supply manpower, equipment and materials, as are required, to provide and confirm compliance with grade and alignment requirements. This is a non-pay item and all costs incurred shall be included in the bid item(s) for the pipe installation.

620.3.2 Placement: At the time of concrete placement, all soil in the trench will be adequately moistened so that water is not drawn from the freshly placed concrete. However, the trench form will be completely free of water, mud, and debris. All forming devices, including the slipforms and hopper of the placement device, shall be thoroughly moistened.

Concrete shall not be placed when temperature of the concrete exceeds 90 degrees Fahrenheit (32 Celsius) or is less than 50 degrees Fahrenheit (10 Celsius). The soil adjacent to the trench shall be at a temperature above freezing.

The pipe shall be constructed in one placement, the entire cross-section being placed monolithically. Inside forms shall be sufficiently rigid to withstand consolidation of the fresh concrete. Placement shall be such as to produce a thoroughly consolidated homogeneous concrete mixture conforming to the test requirements of this specification. Effective consolidation means shall be applied to the fresh concrete over the entire circumference and from within the pipe shell. Consolidation means shall be capable of effectively placing and consolidating fresh concrete at production speeds. Methods of consolidating shall be capable of building up sufficient pressure to effectively bond the concrete to the surrounding earth and to keep loose sand, mud, and water out of the pipe shell.

Under no circumstances will the Contractor be allowed to continue the pipe installation if the vibrators of the cast-in-place machine are inoperable. Portable vibrators or 'stingers' shall only be used to supplement internal vibrators on the machine and not as a sole source to consolidate and distribute the concrete mix.

The Contractor shall make provisions for removing sloughed material, debris and any foreign objects from the trench before and during placement of concrete such that buildup of material does not occur ahead of the machine. In addition, small transverse trenches shall be dug across trench bottom, at distances not to exceed 25 linear feet, to receive soil buildup pushed ahead of the slipform.

(A) Construction Joints - When pipe placement stops in excess of ninety (90) minutes, a construction joint shall be formed. The ends of the pipe that are to be butt contact shall be left in rough condition with a slope between 20 and 45 degrees. Number 4 reinforcing bars shall be embedded 12 inches in the previous pour and 12 inches into the next pour and shall be placed 12 inches on center for pipe 42 inches in diameter or less and shall be placed 18 inches on center for pipe diameters in excess of 42 inches.

Immediately before resuming concrete placement, the surfaces to be bonded shall be cleaned of all laitance, coatings, foreign materials, and loose or defective concrete, thoroughly wetted and coated with a layer of bonding mortar per subsection 620.2.5, contained herein, approximately 1/4 inch (6 mm) thick. In lieu of the bonding mortar, neat cement paste may be thoroughly scrubbed onto the wet surface of the previously placed concrete.

For a joint that may be used for connection to another pipe or structure, a joint shall be made by squaring off the end of the pipe. An excavation shall be made along the sides and bottom of the cast-in-place pipe, for any diameter, to permit casting of a concrete collar having a minimum thickness of 1-1/4 times the pipe wall thickness and lapping the joint by at least 2 times the wall thickness.

The outside top of all joints shall be capped for the entire width of the pipe that is exposed, that is between the earth walls of the excavated trench. This cap shall have a minimum thickness equal to the wall thickness of the pipe and shall lap the joint, both upstream and downstream from the joint by at least twice the wall thickness of the pipe. A cap as described is required regardless of pipe size.

(B) Pipe Dimensions and Tolerances:

(1) The internal diameter of the pipe at any point shall not be less than 95 percent of the nominal diameter, and the average of any four (4) measurements of the internal diameter made at 45 degree intervals shall not be less than the nominal diameter.

(2) Pipe Wall Thickness:

(a) For pipe less than 15 inches (381 mm) inside diameter, the minimum wall thickness shall be 2 inches (50 mm).

(b) For pipe with an inside diameter of 15 inches (381 mm) to 24 inches (610 mm) the minimum wall thickness shall be 2-1/2 inches (63 mm).

(c) For pipe exceeding 24 inches (610 mm) inside diameter, the minimum wall thickness shall be 1/12 of the inside diameter plus 1/2 inch (13 mm).

(3) Offsets at form laps and horizontal edges shall not exceed 1/2 inch (13 mm) for pipe having inside diameter not greater than 42 inches (approximately 1 M); 3/4 inch (19 mm) for pipe having inside diameter greater than 42 inches, but not greater than 72 inches (approximately 1.8 M) and 1 inch (25 mm) for pipe having inside diameter greater than 72 inches.

(C) Pipe Placement:

(1) It is essential that concrete placement be done in a smooth and steady manner with as few starts and stops as is possible. The Contractor shall schedule materials and operate the pipe machine at speeds and in a manner that will achieve this.

(2) The Contractor shall provide an anchoring system for pull of the machine in a manner which will provide the least probability of causing deviations in grade and/or alignment. Adjustments to or modifications in anchoring system, when required in the opinion of the Engineer, shall be made at no additional cost to the project.

620.3.3 Curing and Backfilling

The Contractor shall be responsible for proper curing of the concrete and backfilling the trench to an even grade. Final backfill and compaction shall not be started until concrete has developed a compressive strength of at least 2500 psi (17.3 MPa). The pipe shall be checked for grade, alignment and thickness prior to backfilling. Backfill and ABC slurry shall conform to the requirements of COS Standard Detail No. 2201, or as specified on the plans. Curing shall be performed on such a manner as to prevent the premature drying of the concrete. The Contractor shall use the method described below.

Polyethylene film complying with ASTM C-171, nominal thickness 0.0015 inches (0.038 mm), shall be placed on the exposed top surface of the pipe immediately after the pipe is cast. The film shall be anchored in place with loose soil to assure continuous, adequate curing.

A humid atmosphere within the pipe, as evidenced by condensation on the interior surface shall be maintained for at least seven (7) days following placement, except for a maximum period of 24 hours allowed for removing forms and making repairs. To prevent air drafts which may dry the pipe and to maintain a humid atmosphere inside the pipe, all openings, ends, manholes, and connector pipes shall be kept closed or securely covered, except when actual work is in progress on the inside of the pipe. The pipeline shall be partially filled with water during the curing period when work is not being performed on the inside of the pipe.

620.3.4 Repair

Immediately after removal of the forms, the inside of the pipeline will be inspected for required repairs and conformance with all dimensional requirements including alignment and grade.

The Engineer shall be the sole judge as to the repairability of the deficiencies. Those sections of pipeline which are judged to be non-repairable or which are not within required dimensional tolerances, including alignment and grade, shall be removed and replaced.

When concrete placement is done by a method requiring the use of metal inner forms, the Contractor shall schedule work forces, by extended, staggered or multiple shifts, as required, to provide for removal of forms within 4 to 6 hours of placement of concrete and start of repairing, patching and finishing of pipeline to conform with specification requirements.

When concrete placement is done by methods using pneumatically inflated inner liner, the Contractor shall schedule work forces, by extended, staggered or multiple shifts, as required, to provide for removal of the pneumatic inner liner within 12 hours of placement of concrete and start of repairing, patching and finishing of pipeline to conform with specification requirements.

All rock pockets, non-longitudinal cracks or indentations shall be cleaned out, moistened and filled with 1:2 cement grout or approved epoxy material. Except where, in the opinion of the Engineer, the width and/or length of the crack may indicate a structural deficiency, repairs shall be made as required for longitudinal cracks.

At the discretion of the Engineer, longitudinal cracks exceeding 0.01 inches (0.25 mm) in width and 12 inches (305 mm) in length may be cause for rejection and removal of that portion of the pipe. Subject to the approval of the Engineer, cracks may be repaired using a pressure applied epoxy compound capable of providing structural correction to the area in addition to sealing the void. A longitudinal crack shall be defined as one which the general direction of a 30 degree angle or less with the alignment of the pipe.

Irrespective of concrete placement method, all repairs, patches and finishing shall be completed within 24 hours of concrete placement.

The Contractor, prior to start of concrete placement on project shall submit a written schedule of proposed work activities and work time schedules for the Engineer's review and approval. No time schedule requiring overtime by the Engineer's staff is authorized without specific written approval of the Engineer.

Compliance with this section is a non-pay item and any costs incurred shall be included in the bid proposal item(s) for the pipe.

620.3.5 Finishing

Except for the form offsets, the interior surface of the pipe shall be equivalent to or better than a wood float finish. Form offsets shall be trimmed so as to provide a reasonably tapered slope from surface to surface. The bottom of the pipe below the metal forms shall be finished in a workmanlike manner and shall conform to the general circular circumference of the pipe without sags, dips and humps. All extraneous concrete shall be removed from the interior surface.

620.4 TESTS:

Random tests shall be made of the wall thickness at the top, bottom and sides, approximately every 100 feet, on a daily basis by probes through fresh concrete or small holes drilled through the concrete. Holes shall be properly and permanently closed and sealed, flush with the inside surface of the pipe, after measurements are made, in accordance with the requirements of the fifth paragraph of Subsection 620.3.4, contained herein.

The Contracting Agency shall take and test concrete test cylinders per MAG Section 725 for compressive strength testing at 14 and 28 days. Should the Contractor desire to backfill prior to 14 days, it shall be the Contractor's responsibility to schedule, and pay for, any additional concrete test cylinders and provide results to the Contracting agency. Only concrete test results from a certified testing lab, indicating the concrete has developed the minimum 2500 psi compressive strength required herein shall be accepted as justification for allowing backfilling prior to the receipt of the Contracting Agency's concrete test results. Backfilling shall not take place until approved by the COS Field Engineering Manager or designated representative.

If the 14 or 28 day cylinder tests indicate that the concrete does not meet the specified strength requirements, cores shall be taken from the same section of concrete represented by the faulty test cylinder under the supervision of the Engineer. The concrete should be at least 14 days old before the core specimens are taken. The diameter of the core specimens for the determination of compressive strength should be at least three (3) times the maximum nominal size of the coarse aggregate used and must be at least twice the maximum nominal size of coarse aggregate.

The length of the specimen, when capped, should be twice the core diameter. A core having a maximum height of less than 95 percent of its diameter before capping or a height less than its diameter after capping shall not be tested.

If cores are taken, the Contractor shall patch all core holes in such a manner that the patch will be permanent, will not leak, and will have a smooth interior finish flush with the interior surface of the pipe. Procedures and payment for coring shall be in accordance with applicable portions of MAG Section 725.

The Engineer will evaluate the test results and provide final decision as to any required corrective action.

620.5 MEASUREMENT:

Measurement of cast-in-place concrete pipe will be the number of linear feet of pipe measured horizontally along the pipe axis from end to end of pipe. At changes in diameter, the measurement shall be to center of manhole or transition.

620.6 PAYMENT:

Payment will be made at the contract unit price bid per linear foot to the nearest foot for each size of pipe and shall be compensation in full for furnishing and installing the cast-in-place concrete pipe as specified,

including removal of obstructions, excavation, backfilling, compacting, testing, and all incidental costs not specifically covered in other items in the proposal.

No separate payment will be made for prefabricated tees, fittings and/or lateral pipe connections, the costs of which shall be included in the price per linear foot of storm drain line.

**SECTION 621
CORRUGATED METAL PIPE AND ARCHES**

621.1 DESCRIPTION: *Add pipe classification Type IR to AASHTO Designation M-36.*

621.2 MATERIALS: *Add the following:*

All prefabricated fittings for lateral pipes shall be welded fittings.

Rubber "O" ring gaskets shall conform to the requirements of ASTM C-361. Sleeve gaskets shall be a closed cell rubber in accordance with ASTM D-1056, grade SCE 43.

Add the following subsection:

621.2.1 Material Handling:

The Contractor is responsible for seeing that the pipe arrives and is installed undamaged.

During loading, transportation, unloading, storage and laying, every precaution shall be taken to prevent damage to the corrugated pipe, linings and coatings. Approved slings of nylon or other suitable material which will minimize point loading and coating abrasion shall be used during all handling operations and to install the pipe in trenches. The straps of the slings shall be spaced closely so as to ensure a minimum deflection in the pipe to preserve the integrity of the mortar lining. Under no circumstances shall holes be made in the pipe for lifting purposes.

Open ends of shop-applied, mortar lined pipe shall be tightly sealed using polyethylene plastic wrap with a minimum thickness of 6-mil. The ends of the pipe shall remain tightly sealed for a period of time as determined by the mortar applicator to adequately cure prior to shipment. Any damage to the lining or coating occurring at any point in transit or during installation shall be repaired as described in COS Subsection 760.6 if, in the opinion of the City, a satisfactory repair can be made. Otherwise, the damaged section shall be removed from the job site and replaced at the expense of the Contractor.

621.3 INSTALLATION: *Delete the first sentence and insert the following:*

Pipe trenching and bedding shall conform to the requirements of MAG Section 601 as modified by COS Section 601.

621.3.1 Joints: *Add the following:*

Metal pipe shall be joined using annular corrugated or hugger type metal bands locking in at least one annular corrugation and shall be installed to form a watertight joint. Annular corrugated bands shall use a 1/4-inch thick rubber sleeve gasket the same width as the band. Hugger type metal bands shall use an "O" ring gasket placed in the first annular corrugation of the pipe.

Coupling bands shall conform to COS Subsection 760.4.

Coupling bands shall be evenly drawn together by a minimum of two 1/2-inch diameter galvanized bolts through the use of a bar and strap assembly suitably welded to the band. "O" ring gaskets shall be compressed by tightening the coupling band in accordance with the manufacturer's installation instructions.

Annular joints on concrete lined pipe shall be mortared to a smooth steel trowel finish. Annular joints in smooth metal lined corrugated metal pipe shall be filled after couplings are secured with an appropriate compound approved by the Engineer.

Other methods of joining may be used subject to approval of the Engineer.

SECTION 625
MANHOLE CONSTRUCTION AND DROP SEWER CONNECTIONS

625.1.2 Drop Sewer Manholes: *Add the following sentence:*

For installations of MAG Standard Detail No. 426, Type A, change 2.5 feet minimum to read 1.5 feet minimum.

625.2* Materials: Add new section.

Plastic sheet liner shall be "Amer-Plate T-Lock" by Americoat Corporation or approved equal. Epoxy Coatings shall be Sauereisen "SewerGard No. 210", Somay "Plasite 5371", Raven "404" or approved equal.

625.3.1 Manholes: *Add the following paragraphs:*

Sections of pipe connected to manholes shall be no longer than five (5) feet to minimize adverse impacts to the sewer line due to settlement of the manhole.

When concrete adjustment rings are used for sewer manhole installations, the rings must be sealed on the inside using grout, "Ram-Nec", or approved equal.

Manholes outside of vehicle travel lanes shall be adjusted to 1-1/2 inches above finished grade. All manholes shall have a concrete collar around the ring and cover per COS Standard Detail No. 2270.

All manhole barrels will be sealed at the base with "Ram-Nec" or approved equal.

Approved water stop ring for manhole base penetrations is "Adeka" MC-2005T for pipe diameters 24 inches or less and "Adeka" MC-2010M for pipe diameters greater than 24 inches, or approved equal.

* Epoxy Coatings: 100% solids monolithic coating systems shall be trowel applied per the manufacturer's instructions. Coatings for bases shall have a non-skid surface. Surfaces to be Epoxy coated shall cure for a minimum of 28 days and shall not have received any type of curing agent or sealer. Remove all oil, grease, foreign contaminants and loose laitance prior to the application of the epoxy coating. Sandblasting with fine silica sand to a desired texture equivalent to 40 to 60 grit sandpaper insuring the removal of any and all glaze is required. Hydro blasting is acceptable if first approved by the City Inspector.

Add the following subsection:

625.3.3 Manhole Testing: All manholes installed shall be tested by exfiltration testing or by vacuum testing. Exfiltration testing shall be performed in accordance with MAG Section 615.10(B) and Arizona Department of Environmental Quality (ADEQ) Engineering Bulletin No. 11, Chapter 4, Section B. Exfiltration from manholes shall be limited to 0.1 gallons per hour per vertical foot. Manholes shall be exfiltrated tested for a period of 24 hours.

Vacuum testing shall be performed in accordance with ASTM C 1244. Vacuum testing shall be performed at the top of the manhole cone for manholes located in of paved areas. Manholes outside of paved areas shall be vacuum tested at the ring and cover. A vacuum of 10 inches of mercury negative

pressure shall be drawn on the manhole. The time shall be measured for the vacuum to drop to 9 inches of mercury negative pressure. The manhole shall pass the vacuum test if the time for the vacuum reading to from 10 inches of mercury negative pressure meets or exceeds the following values.

Manhole Depth	Minimum Test Duration (Seconds) - 48" Diameter Manhole	Minimum Test Duration (Seconds) - 60" Diameter Manhole
10 ft. or less	60	75
Greater than 10 ft. to 15 ft.	N/A	90
Greater than 15 ft.	N/A	105

N/A = Not applicable (manholes greater than 10 feet deep shall be 60" diameter).

If manhole joint compound is pulled out during the vacuum test, the manhole shall be disassembled and the joint repaired or replaced, as necessary. The vacuum test shall then be repeated until the manhole passed the test or the manhole is tested and passes the standard exfiltration referenced above.

Testing of sanitary sewer manholes is considered incidental to the price bid for manhole installation and no additional payment shall be made.

Add the following subsection:

625.3.4 Monitoring Manholes: The city shall determine whether or not a sewer user will be required to have a monitoring manhole to test the flow and composition of their sewage. Sewer users with a USEPA Categorical Standard, a sewer discharge of 25,000 gallons per day of process wastewater, or any user that has the potential to discharge a pollutant as determined by the City's Water Quality Division of the Water Resources Department, shall be required to have a monitoring manhole.

Flows of less than 25,000 gpd shall require a City of Scottsdale monitoring/sampling manhole MAG Detail # 420 with a straight channel and no taps or bends for (10') ten feet upstream and downstream of the manhole.

Flows of 25,000 gpd or more shall require a monitoring vault per City of Scottsdale Supplemental Detail # 2460.

Monitoring manholes and vaults shall be located in a twelve (12') foot PUE which extends from the manhole to the existing public sewer. The monitoring manhole shall be accessible at all times for monitoring crews and vehicles.

SECTION 630
TAPPING SLEEVES, VALVES AND VALVE BOXES ON WATER LINES

630.3.1 General: *Add the following sentence to this paragraph:*

All gate valves shall be provided with low-zinc stems.

630.4.2 TAPPING SLEEVES: *Add the following paragraph (C):*

(C) Ties into existing PVC water mains shall be accomplished by installing a stainless steel tapping sleeve and valve. Cast iron tees may be used with City approval. Stainless steel tapping sleeves shall be 360 degree, full circle tapping sleeves and shall conform to the following specifications:

- (1) Body - Stainless Steel Type 304, 14 gauge.
- (2) Flanged Outlet - Stainless Steel Type 304 pipe or tube, Schedule 10 AWWA C-207, Class D, ANSI 150 PSI drilling recessed for tapping.
- (3) Gasket - 1/4 inch thick, ± 0.03 inch, permanently attached to sleeve.
- (4) Test Plug - 3/4 inch, 304 Stainless Steel or Bronze.
- (5) Nuts & Bolts - Stainless Steel 18-8, type 304, Minimum 4 Bolt Pattern Required.

Installation of Kennedy Square Seal and Rich Corey tapping sleeves is prohibited on City of Scottsdale water lines.

630.5 BUTTERFLY VALVES: *Add the following paragraph:*

Butterfly valves will be allowed only for valves 16 inches and larger. All butterfly valves will be tested for proper adjustment. The valve operator shall be accessibly located within a standard manhole per COS Standard Detail No. 2305-1. The manhole cover shall be stamped "City of Scottsdale Water".

Delete paragraph 630.5 BUTTERFLY VALVES: (B) 3 INCHES THROUGH 12 INCHES: in its entirety.

**SECTION 631
WATER TAPS AND METER SERVICE CONNECTIONS**

631.2 MATERIALS: *Add the following paragraph:*

Pack joint meter stops or corp stops shall be used exclusively.

Polyethylene and polybutylene material shall not be used in any water system installation.

631.3.1 General: *Add the following paragraphs:*

Water taps and meter service connections shall be installed in accordance with COS Standard Detail No. 2330. All taps made to existing water lines shall be done by authorized City personnel, or by a Contractor authorized by the City.

Water meters shall not be constructed in driveways sidewalks, washes or retention/detention areas unless approved by the City.

All water service lines constructed under existing pavement shall be installed by mechanical/pneumatic underground boring unless otherwise approved by the COS Transportation Maintenance Director. Water boring is not allowed for construction of water service lines under existing pavement.

631.6 INSPECTION: *Add the following paragraph:*

The location of newly constructed water service lines shall be marked with a 2-inch x 4-inch x 30-inch long wooden stake. The stake shall be driven firmly into the ground exposing a minimum of 12 inches of the stake. The stake shall be labeled to indicate "water service".

PART 700 - MATERIALS

**SECTION 710
 ASPHALT CONCRETE**

710.1 GENERAL: *Add the following paragraph:*

Mixes shall be designated as "R" type (such as R-9.5, R-12.5, etc.) conforming to low traffic design criteria, or "A" type (such as A-12.5, A-19, etc.) conforming to medium and high traffic design criteria.

Delete Table 710-1 in its entirety and replace with the following:

TABLE 710-1		
ASPHALT CONCRETE MIXES		
Designation (mm)	Application	Design Target Lift Thickness (in.)
9.5	Surface Course	1-1/2"
12.5	Surface Course	2"
19.0	Base or Surface Course	3"
25.0	Base Course	4"
37.5	Base Course	5"

**SECTION 715
SLURRY SEAL MATERIALS**

TABLE 715-1: *Make the following revision:*

For TYPE II Slurry Seal Aggregate, the minimum application rate shall be 17 Pounds of Aggregate per Square Yard.

SECTION 736
NON-REINFORCED CONCRETE PIPE

736.1 GENERAL: *Add the following paragraph to this section.*

Prefabricated non-reinforced concrete pipe shall not be allowed for use as a storm drain or culvert material unless specifically approved by the Engineer and by the Transportation Department.

SECTION 737
ASBESTOS-CEMENT PIPE AND FITTINGS
FOR STORM DRAIN AND SANITARY SEWER

737.1 GENERAL: *Add the following paragraph to this section.*

Asbestos-cement pipe shall not be allowed for use as a storm drain or culvert material unless specifically approved by the Engineer and by the Transportation Department.

**SECTION 738
HIGH DENSITY POLYETHYLENE PIPE AND FITTINGS FOR
STORM DRAIN AND SANITARY SEWER**

MAG Section 738 GENERAL HIGH DENSITY POLYETHYLENE PIPE AND FITTINGS FOR STORM DRAIN AND SANITARY SEWER is hereby deleted in its entirety and the following Section substituted:

**SECTION 738
HIGH DENSITY POLYETHYLENE PIPE AND FITTINGS FOR
STORM DRAIN AND SANITARY SEWER**

738.1 GENERAL:

This specification covers the requirements of corrugated high density polyethylene (HDPE) pipe manufactured per AASHTO M-252 (4"-10") (Type S), M-294 (12"-48") (Type S), and the AASHTO Interim Specification for smooth interior/smooth exterior (54"-60") (Type S or D) pipe for gravity flow storm drains and sanitary sewer systems. The HDPE pipe will be in sizes (4"-60") as shown on the plans.

Written approval for the use of HDPE pipe shall be obtained from the Transportation Planning Division for storm sewers and culverts.

738.2 MATERIALS:

738.2.1 Base Material Composition: Pipe base material shall be made from HDPE plastic compounds meeting the requirements of cell classification PE 335420C or higher cell classification in accordance with ASTM D-3350.

738.2.2 Other Pipe Materials: Materials other than those specified under Base Materials shall comply with AASHTO M-294 or M-252.

738.2.3 Gaskets: Rubber gasket shall be manufactured from rubber, synthetic elastomer or a blend of both and shall comply with the physical requirements of ASTM F-477 for water tight joints.

738.2.4 Thermal Welding Material: The HDPE material used for thermally welding the pipe materials shall be compatible with the base material.

738.2.5 Lubricant: The lubricant used for assembly shall comply to the manufacturers recommendations and have no detrimental effect on the gasket or pipe.

738.3 JOINING SYSTEMS:

738.3.1 Joint Type: Joints for pipe and fittings shall be either a) an integrally formed bell and spigot gasketed joint; b) a thermo-molded coupling gasketed joint; or c) an externally corrugated gasketed coupling for soil tight applications.

Joints a) and b) shall provide a seal against exfiltration and infiltration under low pressure. For the purposes of this specification, low pressure is defined as twenty-five (25) feet of water column or less for ASTM F-894 pipe and five (5) feet of water column or less for AASHTO designated pipe. All surfaces of the joint

upon which the gasket may bear shall be smooth and free of any imperfections which could adversely affect sealability.

The assembly of the gasketed joints shall be in accordance with the manufacturer's recommendations. All pipe using joints a) and b) above shall have a homing mark on the spigot end to indicate proper penetration when the joint is assembled.

738.4 FITTINGS AND MANHOLES:

Fittings for corrugated HDPE pipe may include tees, wyes, elbows, plugs, caps, adapters, and reducers. Fittings shall be joined in accordance with Section 738.3. A waterstop gasket shall be provided on any manhole entry or connection to reduce infiltration and exfiltration. Where precast manholes are used, entrance hole must be large enough to allow for proper grouting around the gasket. A non-shrink grout shall be used for grouting.

738.5 CERTIFICATION:

The manufacturer shall furnish a certification that all materials delivered shall comply with the requirements of AASHTO M-252 or M-294 or the Interim AASHTO Specification for corrugated smooth interior/exterior 54 inch and 60 inch HDPE pipe. The certification shall be provided to the Transportation Planning Division in the case of storm sewer or culvert pipe or the Water Resources Department in the case of sanitary sewer pipe.

738.6 DIMENSIONS AND TOLERANCES:

Pipe dimensions shall comply with the dimensions given in AASHTO M-252, M-294, or the Interim Specifications for corrugated smooth interior/exterior 54 inch and 60 inch HDPE pipe. Pipe not complying with the specified tolerances shall be marked with paint on its interior and exterior and immediately removed from the project site.

The minimum pipe stiffness shall comply with the following:

Diameter (inches)	Minimum Pipe Stiffness (psi)	Diameter (inches)	Minimum Pipe Stiffness (inches)
12 or less	50	36	22
15	42	42	20
18	40	48	18
24	34	54	14
30	28	60	12

Markings on the pipe shall be AASHTO M-294, M-252 or MP7-98.

738.7 CARE OF PIPE AND MATERIALS:

Pipe that is gouged, marred, or scratched forming a clear depression shall not be installed and shall be removed.

SECTION 745
PVC PIPE AND FITTINGS FOR STORM DRAIN AND SANITARY SEWERS

745.1 GENERAL: *Delete this paragraph in its entirety and replace it with the following paragraph.*

This specification covers the requirements of polyvinyl chloride (PVC) plastic sewer and storm drain pipe and fittings for gravity flow sewers and building connections and gravity flow storm drains. PVC sewer pipe, fittings, couplings, and joints up to 12 inches in diameter shall be in conformance with the requirements of ASTM D-3034, SDR-35, 46 psi stiffness factor, except as modified herein. PVC sewer and storm drain pipe, fittings, couplings, and joints from 18 inches to 27 inches in diameter shall be in conformance with ASTM F-679, T-1 wall thickness, 46 psi stiffness factor.

**SECTION 756
FIRE HYDRANTS**

756.3 HYDRANTS: *Delete the text in this subsection in its entirety and replace it with the following:*

All fire hydrants furnished to, or installed in, the City shall conform to the following specifications:

- (1) Hydrants shall be designed, manufactured, installed and tested in compliance with the latest edition of AWWA. C-502 Standard for Dry-Barrel Fire Hydrants, as published by the American Water Works Association.
- (2) Hydrants shall be designed to operate at the maximum pressure of the line, and tested at the same p.s.i. as the main line.
- (3) Hydrants shall be of the break flange traffic model type with a replaceable breakable unit immediately above the ground line for minimizing repairs due to traffic damage.
- (4) Hydrants shall be of the compression type. Construction such that the main valve closes with the water pressure to assure no loss of water in the event of damage to the upper portion of the fire hydrant.
- (5) Main valve opening shall have a minimum of diameter of 5 1/4 inch to assure optimum flow. The inside diameter of the barrel shall be a minimum of 7 inches. Facing of the main valve against the seats shall be synthetic rubber or balata.
- (6) Hydrants shall be of the drop top design with O-ring seals to insure that the operating threads will be protected from water entry. Dry top design to include factory lubricated operating mechanism which allows supplemental lubricant to be added in the field without removal of the top section. Standard lubricant shall be either oil or grease, suitable for a temperature range of 40 degrees to 150 degrees F.
- (7) All hydrants shall have a weather shield at the operating nut to protect the clearance area between the top casting and the operating nut.
- (8) The operating nut shall be one-piece bronze casting, both the operating nut and the nozzle cap nuts to be National Standard Pentagon in shape and measure 1 1/2 inch from point of flat at the base of the nut. Nozzle caps to be provided with rubber gaskets.
- (9) Hydrants shall have two 2 1/2 inch diameter hose nozzles with National Standard Fire Hose Coupling Screw Threads, and one 4 1/2 inch diameter pumper nozzle with National Standard Threads. Both the Pumper and Hose Nozzle shall be threaded and locked into place with "O" rings used as pressure seals. The use of caulked type nozzles is prohibited.
- (10) Hydrant nozzle section shall be capable of rotation through 360 degrees with respect to the standpipe to allow the positioning of the hose or pumper nozzles.
- (11) Hydrant shall have identification mark indicating direction of opening right to left (counter clockwise).

(12) Hydrants shall have permanent markings identifying the manufacturer name, size of main valve opening, and year of manufacture.

(13) Hydrants shall have an automatic drain that is operated by the main valve rod. Drain valve is to open as the main valve is closed and close as the main valve is opened. Drain valve systems shall be fully automatic. Port and seats of drain valve to be bronze.

(14) The outside of the hydrant top section shall be painted a minimum of one coat of primer and two finished coats of chrome yellow enamel.

(15) The shoe of the hydrant shall be provided with a mechanical joint connection, 6 inch in size. All interior ferrous surfaces of the shoe exposed to continuous fluid flow (including the valve plate and cup nut) shall be epoxy coated to a minimum dry thickness of 6 mils. Epoxy coating shall be factory applied by an electrostatic or thermosetting process in accordance with the manufacturers printed instructions. The epoxy material used shall be 100 percent powder epoxy or liquid epoxy that conforms to the requirements of AWWA C550 and to the prevailing requirements of the Food and Drug Administration and of the Environmental Protection Agency.

(16) The hydrant shall have bronze valve seat and shall be threaded into bronze drain ring or shoe bushing to prevent electrolysis between these components.

(17) Hydrants shall be designed to permit the use of extension sections and allow all parts to be removable from ground level without requiring excavation of the hydrant.

(18) The friction loss must be guaranteed by the manufacturer to satisfy the following table:

(19) *Pour a PCC Collar around the fire hydrant barrel in accordance with AWWA Standard M 17 as shown in COS Standard 2366.*

756.4 MANUFACTURER: *Modify table 756-1 as follows:*

**TABLE 756-1
 MAXIMUM PERMISSIBLE LOSS OF HEAD FOR HYDRANTS**

No. of Outlet Nozzles	Nom. Diam. of Outlet	Total Flow From Outlet Nozzles GPM	Maximum Permissible Head Loss PSI
2	2 1/2"	500	2.0
1	4 1/2"	600	2.5

Add the following Subsection:

756.5 CERTIFICATION

The Contractor shall provide, to the City, manufacturer certifications attesting the fire hydrants as shown on the submitted product data sheets meet the requirements of this specification.

SECTION 760
COATING CORRUGATED METAL PIPE AND ARCHES

760.2 MATERIALS: *Delete text of subsection and insert the following:*

Corrugated metal products covered by this specification shall be either plain galvanized conforming to the requirements of AASHTO Designation M-218 or aluminized conforming to the requirements of AASHTO Designation M-274, except as modified herein.

Bituminous coatings will not be allowed.

AASHTO M-190 will be modified to include Type E pipe.

Type E pipe - Corrugated metal pipe with Smooth Metal Liner: This pipe shall be manufactured per AASHTO M-36, Type LA except that the lock seam shall be on the tangent of the helical corrugation. The minimum thickness of the pipe shell shall be as required to support the external load with no credit for load carrying given to the liner. The minimum thickness for the liner shall be 18-gage (0.052 inch).

Concrete lined corrugated metal pipe shall conform to the requirements of ASTM A-849, except as modified herein.

(A) Composition - concrete for the lining shall be composed of cement, fine aggregate and water that are well-mixed and of such consistency as to produce a dense, homogenous, non-segregated lining.

(B) Cement - Portland cement shall conform to the requirements of ASTM C-150 Type II, low alkali.

(C) Aggregates - aggregate shall conform to MAG Section 701.

(D) Mixture - the aggregate shall be sized, graded, proportioned and thoroughly mixed with such proportions of cement and water as will produce a homogenous concrete mixture of such quality that the pipe will conform to the design requirements of this specification. In no case, however, shall the proportions of Portland cement, blended cement or Portland cement plus pozzolanic admixture be less than 564 lb./cu. yd. of concrete.

760.3 BASE METAL, SPALTER AND FABRICATION: *Add the following paragraphs:*

Concrete Lined Corrugated Metal Pipe: The following items in addition to those described in Helically Corrugated Metal Pipe apply. The lining shall have a minimum thickness of 1/4 inch above the crest of the corrugations. The lining shall be plant applied by a machine traveling through a stationary pipe. The rate of travel of the machine and the rate of concrete placement shall be mechanically regulated so as to produce a homogenous non-segregated lining throughout. The lining machine shall also mechanically trowel the concrete lining as the unit moves through the pipe.

Each metal pipe section shall be fabricated with a minimum of two annular re-rolled corrugations at each end for the purpose of joining the pipes with an approved coupling band. Smooth metal lined corrugated metal pipe shall be re-rolled with liner intact to crimp the liner and shell in the annular configuration.

760.4 COUPLING BANDS: *Delete text of subsection and add the following:*

Fabricated coupling bands shall meet the requirements of AASHTO M-36, except as modified herein. Metal bands may be manufactured of material two gages lighter than that gage specified for the pipe to a minimum thickness of 0.064 inch (16 gage).

Coupling bands shall be one-piece for all pipe diameters to 48 inches. Pipe diameters larger than 48 inches shall use two-piece coupling bands. Coupling bands shall be a minimum 10 1/2 inches wide, formed with a minimum of two annular corrugations that are spaced to provide nesting of the second annular corrugation of each pipe.

Add the following subsection:

760.6 REPAIRS:

Concrete Lined Corrugated Metal Pipe - The pipe shall be inspected for cracks after all backfilling of the pipe trench has been completed and accepted. The type of material used for crack repairs shall be submitted to the Engineer for approval prior to the start of any corrective work. Spalling, separations or offsets in the lining shall be repaired by approved methods using epoxy materials.

All cracks, any part of which is 1/16 inch or more in width shall be repaired for their entire length. The crack shall be filled with an approved epoxy joint filling material that will bond the two faces of the crack. The finished interior surface of the pipe at the location where cracks are repaired shall be cleaned with any extraneous material removed, such that the surface matches the adjacent mechanically trowelled surface.

SECTION 787
GRAY IRON CASTINGS

787.7 ASPHALTUM COATING: *Delete subsection in its entirety.*