ENGINE ALLEY WATERLINE IMPROVEMENTS
AND
TUNNEL ENHANCEMENT PLANS
(CP133962 – CAMP)

SPECIFICATIONS

March 30, 2012

Drexel, Barrell & Co.
Engineers – Surveyors

Martin / Martin
Consulting Engineers
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1.01 CONDITIONS AND REQUIREMENTS

Division 1 - General Requirements shall govern work under all Divisions of the Specifications.

1.02 SPECIFICATION LANGUAGE EXPLANATION

Specifications are of abbreviated, simplified or streamlined type and include incomplete sentences. Omissions of words or phrases such as "the Contractor shall," "in conformity therewith," "shall be," "as noted on the Drawings," "a," "the" are intentional. Supply omitted words or phrases by inference in same manner as they are when "NOTE" occurs on Drawings. Supply words "shall be" or "shall" by inference when colon is used within sentences or phrases. Supply words "on the Drawings" by inference when "as indicated" is used with sentences or phrases.

Where reference is made to specifications, societies, institutes, or associations or manufacturer's directions, they are, except as may be inconsistent herewith, made part of specifications, to same extent as if written out in full herein. Use latest edition, at time of bidding, if a date is not given.

1.03 SUBMITTALS

A. Prepare data for use by the University of Colorado, Facilities Management personnel.

B. Format:
   1. Submit electronically in Portable Document Format (PDF) format as one document, OCR (Optical Character Recognition) searchable, bookmarked according to the Construction Specifications Institute (CSI) standards.
   2. Title shall be "SPECIFICATIONS", and shall include:
      a. Name of project and submittal stage and date of submittal (month, day, and year).
      b. University of Colorado Project number (Include on cover and in header or footer of each page)

1.04 CONTENT OF MANUAL

A. An electronically-written table of contents shall be provided for each volume, arranged according to CSI standards.
   Include the following:
   1. Name of responsible installing principal contractor, address, and telephone number.

1.05 ABBREVIATIONS

References in Contract Documents to trade associations, technical societies, recognized authorities and other institutions include following organizations, which are sometimes referred to only by corresponding abbreviations:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA</td>
<td>Aluminum Association</td>
</tr>
<tr>
<td>AAMA</td>
<td>Architectural Aluminum Manufacturer's Association</td>
</tr>
<tr>
<td>ACI</td>
<td>American Concrete Institute</td>
</tr>
<tr>
<td>Acronym</td>
<td>Full Name</td>
</tr>
<tr>
<td>---------</td>
<td>-----------</td>
</tr>
<tr>
<td>AIMA</td>
<td>Acoustical and Insulating Materials Association (successor to AMA and IBI)</td>
</tr>
<tr>
<td>AISC</td>
<td>American Institute of Steel Construction</td>
</tr>
<tr>
<td>AI SI</td>
<td>American Iron and Steel Institute</td>
</tr>
<tr>
<td>AITC</td>
<td>American Institute of Timber Construction</td>
</tr>
<tr>
<td>AMA</td>
<td>Acoustical Materials Association</td>
</tr>
<tr>
<td>ANSI</td>
<td>American National Standards Institute (successor to USASI and ASA)</td>
</tr>
<tr>
<td>APA</td>
<td>American Plywood Association</td>
</tr>
<tr>
<td>ASHRAE</td>
<td>American Society of Heating, Refrigerating and Air Conditioning Engineers</td>
</tr>
<tr>
<td>ASTM</td>
<td>American Society for Testing Materials</td>
</tr>
<tr>
<td>AWI</td>
<td>Architectural Woodwork Institute</td>
</tr>
<tr>
<td>AWPA</td>
<td>American Wood Preservers Association</td>
</tr>
<tr>
<td>AWS</td>
<td>American Welding Society</td>
</tr>
<tr>
<td>CDA</td>
<td>Copper Development Associations, Inc.</td>
</tr>
<tr>
<td>CM/GC</td>
<td>Construction Manager/General Contractor</td>
</tr>
<tr>
<td>CRA</td>
<td>California Redwood Association</td>
</tr>
<tr>
<td>CR SI</td>
<td>Concrete Reinforcing Steel Institute</td>
</tr>
<tr>
<td>CS</td>
<td>Commercial Standard (U.S. Department of Commerce)</td>
</tr>
<tr>
<td>DFPA</td>
<td>Douglas Fir Plywood Association</td>
</tr>
<tr>
<td>EPA</td>
<td>Environmental Protection Agency</td>
</tr>
<tr>
<td>FGMA</td>
<td>Flat Glass Marketing Association</td>
</tr>
<tr>
<td>FIA</td>
<td>Factory Insurance Association</td>
</tr>
<tr>
<td>FM</td>
<td>Factory Mutual Engineering Division</td>
</tr>
<tr>
<td>FS</td>
<td>Federal Specification</td>
</tr>
<tr>
<td>MIA</td>
<td>Marble Institute of America</td>
</tr>
<tr>
<td>MIL</td>
<td>Military Specification</td>
</tr>
<tr>
<td>MILMA</td>
<td>Metal Lath Manufacturer's Association</td>
</tr>
<tr>
<td>NAAMM</td>
<td>The National Association of Architectural Metal Manufacturers</td>
</tr>
<tr>
<td>NBFU</td>
<td>National Board of Fire Underwriters</td>
</tr>
<tr>
<td>NBS</td>
<td>National Bureau of Standards</td>
</tr>
<tr>
<td>NCMA</td>
<td>National Concrete Masonry Association</td>
</tr>
<tr>
<td>NEC</td>
<td>National Electric Code (of NBFU)</td>
</tr>
<tr>
<td>NEMA</td>
<td>National Electrical Manufacturers' Association</td>
</tr>
<tr>
<td>NFPA</td>
<td>National Fire Protection Association</td>
</tr>
<tr>
<td>NIOSH</td>
<td>National Institute of Occupational Safety and Health</td>
</tr>
<tr>
<td>NMWIA</td>
<td>National Mineral Wool Insulation Association</td>
</tr>
<tr>
<td>NPVLMA</td>
<td>National Paint, Varnish and Lacquer Manufacturers' Association</td>
</tr>
<tr>
<td>NTMA</td>
<td>The National Terrazzo and Mosaic Association</td>
</tr>
<tr>
<td>OSHA</td>
<td>Occupational Safety and Health Administration</td>
</tr>
<tr>
<td>PCA</td>
<td>Portland Cement Association</td>
</tr>
<tr>
<td>PCI</td>
<td>Prestressed Concrete Institute</td>
</tr>
<tr>
<td>PEI</td>
<td>Porcelain Enamel Institute</td>
</tr>
<tr>
<td>PS</td>
<td>Product Standard (U.S. Department of Commerce)</td>
</tr>
<tr>
<td>SCI</td>
<td>Structural Clay Products Institute</td>
</tr>
<tr>
<td>SDI</td>
<td>Steel Deck Institute</td>
</tr>
<tr>
<td>SJI</td>
<td>Steel Joist Institute</td>
</tr>
<tr>
<td>SMACNA</td>
<td>Sheet Metal and Air Conditioning Contractor's National Association</td>
</tr>
<tr>
<td>SPA</td>
<td>Southern Pine Association</td>
</tr>
<tr>
<td>SPI</td>
<td>The Society of Plastic Industry, Inc.</td>
</tr>
<tr>
<td>SPR</td>
<td>Simplified Practice Recommendation (U.S. Department of Commerce)</td>
</tr>
<tr>
<td>SSPC</td>
<td>Steel Structures Painting Council</td>
</tr>
<tr>
<td>SWI</td>
<td>Steel Window Institute</td>
</tr>
</tbody>
</table>
1.04 LAYING OUT WORK

The Contractor will furnish reference bench mark and maintain bench mark and all other grades, lines, and levels and dimensions as indicated in the Contract Documents. Report any errors or inconsistencies in above to Owner before commencing work.

Except as delegated by subcontract or normal trade practice, the Contractor will be responsible for all lines, elevations, and measurements of work indicated.

1.05 EXAMINATION OF SITE

Failure to visit the site will in no way relieve any Contractor from the necessity of furnishing materials or performing work that may be required to complete work in accordance with the Contract Documents without additional cost to Owner.

END OF SECTION
PART 1 - GENERAL

1.01 SCHEDULE OF DRAWINGS, SPECIFICATIONS AND ADDENDA

The following Drawings, Project Manual, and Addenda from the Contract Documents.

A. Set(s) of Drawings & project manuals dated March 20, 2012. Drawing list is as follows:

<table>
<thead>
<tr>
<th>Sheet No.</th>
<th>Titled</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1-</td>
<td>Cover</td>
</tr>
<tr>
<td>C1.1-</td>
<td>Notes</td>
</tr>
<tr>
<td>C2-</td>
<td>Master Utility Plan (1 of 3)</td>
</tr>
<tr>
<td>C3-</td>
<td>Master Utility Plan (2 of 3)</td>
</tr>
<tr>
<td>C4-</td>
<td>Master Utility Plan (3 of 3)</td>
</tr>
<tr>
<td>C5-</td>
<td>Traffic - Pedestrian Control Plan</td>
</tr>
<tr>
<td>C6-</td>
<td>Details (1 of2)</td>
</tr>
<tr>
<td>C7-</td>
<td>Details (2 of 2)</td>
</tr>
<tr>
<td>C8-</td>
<td>CU Landscape Details</td>
</tr>
<tr>
<td>L1-</td>
<td>Landscape/Hardscape Improvements</td>
</tr>
<tr>
<td>S1.0-</td>
<td>Structural notes</td>
</tr>
<tr>
<td>S1.1-</td>
<td>Area 1 Demo Plan</td>
</tr>
<tr>
<td>S1.2-</td>
<td>Area 2 Demo Plan</td>
</tr>
<tr>
<td>S2-</td>
<td>Tunnel Plans</td>
</tr>
<tr>
<td>S3-</td>
<td>Tunnel Plans</td>
</tr>
<tr>
<td>S4-</td>
<td>Tunnel Plans</td>
</tr>
<tr>
<td>S5-</td>
<td>Tunnel Plans</td>
</tr>
<tr>
<td>S6-</td>
<td>Details</td>
</tr>
<tr>
<td>S7-</td>
<td>Details</td>
</tr>
</tbody>
</table>


C. Addenda: All Addenda issued prior to bidding.

1.02 WORK COVERED BY CONTRACT DOCUMENTS

A. Work covered: Work under this contract includes all materials, equipment and labor necessary to complete the work indicated on the drawings, described in specifications, addenda or reasonably inferred.

1.03 CONTRACTORS

All work will be executed under one prime construction contract between the Owner and the Contractor.

Except as indicated otherwise, all work under this contract will be under the direction of the prime contractor.

1.04 JOB CONDITIONS

A. Limit construction operations to those methods and procedures which will not adversely and unduly affect the Owner's occupied spaces inclusive of parking facilities.
B. Do not interrupt building access and use, except as permitted by the Owner.

Provide **eight (8)** work days notice to the Owner of construction activities which will severely impact the occupancy and use of adjacent areas.

C. Provide temporary barriers and/or partitions as required to protect the occupants of the building and the general public from injury due to the work of this project; and/or to protect adjacent areas of the building from the spread of dust and dirt caused by the work or this project.

Remove temporary barriers and partitions upon completion of the Project.

1. Temporary partitions shall be constructed of 1/2" plywood on the construction face and nominal 2" X 4" wood studs and 1/2" gypsum wallboard on the public occupied face.

D. Do not interrupt power, lighting, plumbing, telephone and HVAC services to occupied areas without Owner’s approval. Such interruptions must be scheduled at least **eight (8)** work days in advance and have Owner’s approval.

E. The work is divided into two areas with the first area required to be completed on or before June 6, 2012. See Contract Drawing sheet C5 for details and direction. There are Liquidated Damages associated with this area. See General Conditions Article 46 and Article 54D for reference.

1.05 PROTECTION OF WORK AND ADJACENT PROPERTY

A. Buildings and property adjacent to work included in this project may be subject to damage due to construction operations.

Prior to the start of the work included in this Contract engage the services of a photographer or self-perform the work to record the existing condition of adjacent structures and property. Contractor shall provide one set **set on disk** to the Owner. Sufficient photos with adequate detail to thoroughly document the conditions surrounding the work shall be provided.

B. At the completion of the project, Contractor shall restore existing buildings, landscaping, parking facilities and property to same condition as prior to the start of the work.

C. In addition to the requirements of the General Conditions of the Contract for Construction, the Contractor shall:

1. Notify, in writing, the Owner of University or private property which interferes with the work and arrange with them for disposition of such property to include but not limited to bike racks and benches.
2. Provide and maintain proper shoring and bracing to prevent earth from caving or washing into excavation.
3. Provide and maintain proper shoring and bracing for existing underground utilities, sewers, etc., encountered during excavation work, to protect them from collapse or other type of damage until such time as they are to be removed, incorporated into the work of this project, or can be properly back-filled upon completion of new work.
4. Weather Protection: Provide protection against rain, snow, wind, ice, storms, or heat so as to maintain work, materials, apparatus, and fixtures free from injury or damage. At the end of each day's work, cover new work likely to be damaged.

5. Provide and maintain adequate protection of the work from damage due to freezing, especially freezing earth and soils. Risk of proceeding with the work on or with freezing or frozen materials will be the sole responsibility of the Contractor.

6. Water Protection: Provide protection from damage at all times from rain water, ground water, backing up of drains or sewers, and other water. Provide pumps and equipment enclosures to provide this protection.

7. The Contractor will maintain free of obstructions and debris, all designated corridors and emergency exits, handicap access ramps and sidewalks to building. Provide temporary directional handicapped signage for routing to the nearest accessible facilities.

1.06 EXISTING FURNITURE AND EQUIPMENT

The Owner will remove or relocate existing movable furniture and equipment from the areas in which the Contractor is working. Notify the Owner not less than three days prior to starting work in areas where furniture and equipment require moving.

1.07 CONTRACTOR'S ACCESS PARKING AND STAGING AREAS

A. Work included in this project will need to be performed within the limitations of available access at the site. The University shall limit the area available for staging and parking due to the additional number of construction projects planned during the execution of this contract. Contractor shall adjust the means and methods of construction to allow for the restrictions surrounding the site.

B. All parking on campus except for some one-hour zones on city streets and a few metered spaces is under control and authority of the Parking and Transportation Services (PTS) of the University. All University parking is by permit only.

C. Types of parking and staging are defined as follows:

- **General Staging Areas** are approved areas adjacent to the site when available or in University designated group staging yards. General Staging Areas may be used for any purpose, including employee parking, on a space available basis, but must be coordinated through the UCB Project Manager and PTS. Vehicles may not park outside of general staging areas except in areas coordinated and approved by PTS.

- **Restricted Staging Areas** are approved areas near the site for the construction dumpster, off-loading of equipment, contractor’s work trailer, and materials that are soon to be incorporated into the work. No vehicles shall park in a restricted staging area for more than 20 minutes between the hours of 8:00 a.m. and 5:00 p.m. weekdays.

- **Contractor Employee Parking** are areas for workers needing parking on campus. Coordinate through UCB Project Manager and PTS.

- **Prohibited Parking** are areas designated in the Contract Documents as No Parking areas. The contractor shall not allow any parking in areas so designated under any circumstance.

D. The restrictions in this Section are in addition to any other restrictions or rules provided by PTS.
Fees shall be assessed for the use of any PTS facility for staging and construction activities.

E. The designated staging area for this project is noted on contract drawing sheet C5.

F. Vehicles parked on sidewalks or in landscape areas outside the designated staging areas cause damage to University property. The contractor shall reimburse the University $25.00 per vehicle per occurrence for vehicles parked outside the designated staging areas. This amount shall be in addition to any fines which might be levied by PTS.

1.08 OCCUPANCY REQUIREMENTS

A. Owner may occupy designated areas for the purpose of storage of furnishings and equipment and installation of equipment.

B. Execute Certificate of Substantial Completion for each designated portion of work prior to Owner occupancy. Contractor shall allow:
   1. Access for Owner personnel.
   2. Use of parking facilities.
   3. Operation of HVAC and electrical systems.

C. On occupancy, Owner will provide, for occupied areas:
   1. Operation of HVAC and electrical systems.
1.09 CONSTRUCTION AND SEQUENCE SCHEDULE: See contract drawing sheet C5 and planning schedule for specific direction with respect to the construction sequencing.

A. 1. The construction sequence schedule and related drawings are intended to aid the Contractor in bidding and in the preparation of a specific construction schedule. Deviations of sequence may be made upon approval of the Owner and the Architect. The preparation of a specific construction schedule remains the responsibility of the Contractor.

1.10 TEMPORARY ELECTRIC SERVICE

A. Connect to existing power service. Power consumption shall not disrupt owners need for continuous service. Owner to pay for power consumed. Contractor to pay for the means to connect to a temporary power source. Submit a drawing for review and approval prior to connecting to any building for any temporary power service. Provide power outlets for construction operations, branch wiring, distribution boxes, and flexible power cords as required.
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and other Division 1 Specification sections, apply to work of this section.

1.02 SURVEYS, LAYOUTS, AND LEVELS

A. General: Working from lines and levels established by the existing building, and as shown in relation to the work, establish and maintain bench marks and other dependable markers to set the lines and levels for the work of construction as needed to properly locate every element of the work of the entire project. Calculate and measure required dimensions as shown (within recognized tolerances if not otherwise indicated); do not scale the drawings to determine dimensions. Continuously advise tradesmen performing the work of the marked lines and levels provided for use in the layout of work.

1.03 PROJECT RECORD DOCUMENTS

A. Maintain at job site, one copy of:
   1. Contract Drawings
   2. Specifications
   3. Addenda
   4. Reviewed Shop Drawings
   5. Change Orders
   6. Other Modifications to Contract
   7. Field Test Records
   8. As-Built Drawings

B. Maintain documents in clean, dry, legible condition and do not use record documents for construction purposes. Make documents available at all times for inspection by the Consultant and Owner.

C. Label each document "Project Record" in 1" or larger printed letters.

D. Record drawing information in colored pencil with different colors for the various systems and defined by color legend.

E. Record drawings and specifications shall include the following:
   1. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure. Location of concealed valves, dampers, controls, balancing devices, junction boxes, clean-outs, and other items requiring access or maintenance.
   2. Field changes of dimension and detail, changes made by Change Order or Field Order and details not on original contract drawings.
   3. Fire protection and alarm systems shop drawings.
F. Submit all record drawings to the Consultant at the completion of the project.

1.04 CLEANING

A. Cleaning and Protection Work: At the time each unit of work or element of the construction is completed (substantially) in each area of the Project, clean the unit or element to a condition suitable for occupancy and use (as intended), and restore minor or superficial damage. Replace units and elements which are damaged beyond successful restoration. Clean and restore adjoining surfaces and other work which was soiled or damaged (superficially) during the installation; replace other work damaged beyond successful restoration. Where the performance of subsequent work could possibly result in damage to the complete unit or element, provide protective covering or other provisions to minimize possible damage. Repeat cleaning and protection operations during remainder of construction period, wherever work might otherwise be damaged by sustained soiling or exposure.

B. During Construction: Oversee cleaning and ensure that building, grounds, and public properties are maintained free from accumulation of waste materials and rubbish. At reasonable intervals during daily progress of work, clean up site and access and dispose of waste materials, rubbish, and debris. Vacuum clean interior building areas when ready and continue vacuum cleaning on an as-needed basis until building is ready for acceptance or occupancy.

1.05 PROJECT SIGN

Erect no project sign or job-site sign of any kind, except warning signs as specified in Section 01500, without written authorization of the Owner.

1.06 COORDINATION

A. The Contractor shall coordinate the work so as not to interfere with the building custodian's normal cleanup activities.

B. The Contractor shall be responsible for coordinating all the work of the project. The Contractor shall coordinate the efforts of all subcontractor(s) and the deliveries of suppliers so that the work progresses in an orderly fashion without delay towards timely completion of a complete project in accordance with the drawings and specifications.

C. The Contractor shall note that concurrent with his work, other contractors, suppliers, and the Owner's facilities and maintenance personnel may be working in relatively close proximity. The Contractor will be solely responsible for coordinating his work with that of other contractors and will make no claims for failure to do so.

1.08 METHODS OF CONSTRUCTION

A. The procedure and method of construction is the prerogative and the responsibility of the Contractor. If professional assistance is required to safely implement method of construction, the Contractor shall employ professional help at contractor’s expense and direction.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Schedule of allowances.
   2. Selection of products.
   3. Adjustment of costs.

1.02 ALLOWANCES FOR PRODUCTS

A. The amount of each allowance shall include:
   1. The cost of the Product to the Contractor.
   2. Delivery to the site.
   3. Applicable taxes.
   4. Handling at the site.
   5. Protection.
   7. Contractor’s and Subcontractor’s overhead and profit.
   8. Other expenses required to complete the installation.

1.03 SELECTION OF PRODUCTS UNDER ALLOWANCES

A. Contractor’s Duties:
   1. Assist Owner in determining qualified suppliers or installers.
   2. Obtain proposals from suppliers and installers.
   3. Make appropriate recommendations.

1.04 ADJUSTMENT OF COSTS

A. Should the net cost be more or less than the specified amount of the allowance, the Contract
   Sum will be adjusted accordingly by Change Order.
   1. The amount of the Change Order will recognize:
      a. Any changes in handling costs at the site.
      b. Labor.
      c. Installation costs.
      d. Overhead and profit.
      e. Other expenses caused by the selection under the allowance.

B. Submit any claims for anticipated additional costs at the site.

C. At contract close-out, reflect all approved changes in contract amounts in the final statement of
   accounting.

PART 2 - PRODUCTS
Not Used
PART 3 - EXECUTION

3.01 SCHEDULE OF ALLOWANCES

Note to specifier: List specifications section with description and provision for allowance, and allowance amount.

ND OF SECTION
PART 1 - GENERAL

1.01 GENERAL

Quantities indicated on the drawing or extra quantities specified shall be included in the Contractor's Base Bid. For Adding or Deducting from Base Bid quantities, the unit prices described in this section will be applied. The Contractor will be notified, in writing, of the quantities applicable for each unit price, and the Contract Price will be adjusted accordingly by Change Order.

All unit prices shall include all labor, materials, equipment, services, delivery to the project, overhead, profit, insurance, and all other incidental expenses to complete the work specified unless indicated otherwise. All work covered by unit prices shall be performed in accordance with requirements of the applicable sections of the Specifications.

1.02 UNIT PRICES

<table>
<thead>
<tr>
<th>ITEM</th>
<th>UNIT PRICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Flowfill, per cu yard</td>
<td>$ _______ each</td>
</tr>
<tr>
<td>b. Pavers, per sq ft</td>
<td>$ _______ each</td>
</tr>
<tr>
<td>c. 6&quot; reinforced concrete SOG, per sq ft</td>
<td>$ ____________________________ each</td>
</tr>
<tr>
<td>d. Reinforced tunnel collar, per linear ft</td>
<td>$ _______ each</td>
</tr>
<tr>
<td>e. 8” gate valves, each</td>
<td>$ _______ each</td>
</tr>
<tr>
<td>f. 4” gate valves, each</td>
<td>$ _______ each</td>
</tr>
</tbody>
</table>

END OF SECTION
PART 1 - GENERAL

1.01 GENERAL ALTERNATE REQUIREMENTS

A. General: The description for each alternate is recognized to be incomplete and abbreviated but implies that each change must be complete for the scope of work affected. Refer to applicable sections and to applicable drawings for the specific requirements of the owner, whether or not references are so noted in the description of each alternate. Modify surrounding work as required to integrate with the work of each alternate.

1.02 SPECIFIC ALTERNATES

A. Add Alternate No. 1:

ADD Alternate 1, as shown on Sheets C7 & S6, Add 6" reinforced concrete.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. General Contractor is responsible for all of the work of this contract.
   1. Assign and subcontract portions of the work as required to assure that all work is constructed in compliance with these documents.
   2. Coordinate the work of the several subcontractors for the project.
   3. Coordinate work of this contract with work by separate contractors.

B. Each subcontractor shall:
   1. Coordinate work of his own employees and subcontractors.
   2. Expedite his work to assure compliance with schedules.
   3. Coordinate his work with that of other subcontractors and work by separate contractor.
   4. Comply with orders and instructions of owner.

C. Related Requirements
   1. All Division 1 Sections.

1.02 CONSTRUCTION ORGANIZATION AND START-UP

A. Establish on-site lines of authority and communications.
   1. Attend pre-construction meeting with subcontractors upon commencement of the project.
   2. Establish procedures for intra-project communications.
      a. Submittals.
      b. Reports and records.
      c. Recommendations.
      d. Coordination Drawings.
      e. Schedules.
      f. Resolution of conflicts.
      a. Consult with Architect to obtain interpretation.
      b. Assist in resolution of questions or conflicts which may arise.
      c. Transmit written interpretations to subcontractors, and to other concerned parties.
   4. Assist in obtaining permits and approvals.
      a. Obtain building permits and special permits required for work or for temporary facilities.
      b. Verify that subcontractors have obtained inspections for work and for temporary facilities.
   5. Control the use of site.
      a. Supervise field engineering and site layout.
      b. Allocate space for each subcontractor's use for field offices, sheds, work and storage areas.
      c. Establish access, traffic and parking allocations and regulations.
      d. Monitor use of site during construction.
1.03 CONTRACTOR DUTIES

A. Construction Schedules.
   1. Coordinate schedules with several subcontractors.
   2. Monitor schedules as work progresses.
      a. Identify potential variances between schedules and probable completion dates
         for each phase.
      b. Recommend adjustments in schedule to meet required completion dates.
      c. Adjust schedules of subcontractors as required.
      d. Document changes in schedule.
   3. Observe work of each subcontractor to monitor compliance with schedule.
      a. Verify that labor and equipment are adequate for the work and the schedule.
      b. Verify that product procurement schedules are adequate.
      c. Verify that product deliveries are adequate to maintain schedule.

B. Process Shop Drawings, Product Data and Samples.
   1. Review for compliance with Contract Documents.
      a. Field dimensions and clearance dimensions.
      b. Relation to available space.
      c. Relation to other trades, equipment and systems.
      d. Submit to Architect.

C. Monitor the use of temporary utilities.
   1. Verify that adequate services are provided and maintained.

D. Inspection and Testing.
   1. Inspection work to assure performance in accord with requirements of Contract
      Documents.
   2. Administer special testing and inspections of suspected work.
   3. Reject work which does not comply with requirements of Contract Documents.
   4. Coordinate testing laboratory services.
      a. Verify that required laboratory personnel are present.
      b. Verify that tests are made in accordance with specified standards.
      c. Review test reports for compliance with specified criteria.
      d. Recommend and administer required retesting.

E. Monitor contractor’s periodic cleaning.
   1. Enforce compliance with specifications.
   2. Resolve any conflicts.

F. Coordinate changes.
   1. Recommend necessary or desirable changes.
   2. Assist owner in negotiating change orders.
   3. Promptly notify all subcontractors of pending changes.

G. Maintain Reports and Records at Job Site available to Architect and Subcontractors.
   1. Log progress of work of each subcontractor.
   2. Records
      a. Contracts.
      b. Purchase orders.
GENERAL REQUIREMENTS

SECTION 01041

PROJECT COORDINATION

3. Obtain information from subcontractors and maintain file of Project Record Documents.
4. Assemble documentation for handling of claims and disputes.

H. Coordinate work of this Contract and requirements of this section with work by Separate Contract including but not limited to:
   1. Removal of asbestos containing materials by separate contract.

1.04 CONTRACT CLOSEOUT

A. Coordinate equipment start-up.
   1. Provide seven days notification prior to start-up of each item.
   2. Ensure that each piece of equipment or system is ready for operation.
   3. Execute start-up under supervision of responsible persons in accordance with manufacturer's instructions.
   4. Perform required testing and balancing.
   5. Record dates of start of operation of systems and equipment. Submit written report that equipment or system has been properly installed and is functioning correctly.
   6. Provide written notice of beginning of warranty period for equipment put into service.

B. Demonstration and Instructions
   1. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to Substantial Completion.
   2. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, seasonal operation, and shutdown of each item of equipment.

C. At completion of work of each Section, conduct an inspection to assure that
   1. Specified cleaning has been accomplished.
   2. Temporary facilities have been removed from site.

D. At completion
   1. Conduct an inspection to list work to be completed or corrected.
   2. Supervise correction and completion of work as established in Certificate of Completion.

E. When a portion of the Project is occupied prior to final completion, coordinate established responsibilities of each subcontractor.

F. Final completion.
   1. When each Subcontractor determines that work is finally complete, conduct an inspection to verify completion of work.
   2. Assist owner and architect in inspection.

G. Administer contract closeout.
   1. Receive and review Subcontractor's final submittals.
   2. Transmit to architect with recommendation for action.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. Carefully coordinate the interface between Division 15 (Mechanical) and Division 16 (Electrical) before submitting any equipment for review or commencing installation.

B. Responsibility: Unless otherwise indicated, all motor and controls for Division 15 equipment shall be furnished, set in place and wired in accordance with the following schedule:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>FURNISHED UNDER</th>
<th>SET IN PLACE UNDER</th>
<th>POWER WIRING UNDER</th>
<th>CONTROL WIRING UNDER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment Motor</td>
<td>15</td>
<td>15</td>
<td>16</td>
<td>-</td>
</tr>
<tr>
<td>Automatically Controlled</td>
<td></td>
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<tr>
<td>Starter/contractors:</td>
<td>15</td>
<td>16</td>
<td>16</td>
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<tr>
<td>Separate</td>
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<tr>
<td>Factory Mounted &amp; Wired</td>
<td>15</td>
<td>15</td>
<td>16</td>
<td>15</td>
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<tr>
<td>In Motor Control Centers</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>16</td>
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<tr>
<td>Manually Controlled</td>
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<tr>
<td>Starter/Contractors:</td>
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<tr>
<td>Separate</td>
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<tr>
<td>Factory Mounted &amp; Wired</td>
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<td>15</td>
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<tr>
<td>Motor Speed Controllers</td>
<td>15</td>
<td>16</td>
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<tr>
<td>Disconnect (Note 1) Switches</td>
<td>16</td>
<td>16</td>
<td>16</td>
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<tr>
<td>Contactors</td>
<td>16</td>
<td>16</td>
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<td>-</td>
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<tr>
<td>Thermal Overload (Note 1) Switches</td>
<td>16</td>
<td>16</td>
<td>16</td>
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<tr>
<td>Manual Operation (Note 2)</td>
<td>16</td>
<td>16</td>
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<tr>
<td>Switches</td>
<td>16</td>
<td>16</td>
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<td>Control Relays (Note 2)</td>
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<tr>
<td>Control Transformers</td>
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<td>15</td>
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<tr>
<td>Control Circuit Outlets</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>-</td>
</tr>
<tr>
<td>Thermostats (Note 2)</td>
<td>15</td>
<td>15</td>
<td>-</td>
<td>15</td>
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<tr>
<td>ITEM</td>
<td>FURNISHED UNDER</td>
<td>SET IN PLACE UNDER</td>
<td>POWER WIRING UNDER</td>
<td>CONTROL WIRING UNDER</td>
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<td>---------------------------------------------------------------------</td>
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<tr>
<td>Time Switches (Note 2) Not in Control Panel</td>
<td>15</td>
<td>15</td>
<td>16</td>
<td>15</td>
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<tr>
<td>Push Button Stations, Pilot Lights</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>16</td>
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<tr>
<td>Thermostats (Note 2)</td>
<td>15</td>
<td>15</td>
<td>16</td>
<td>15</td>
</tr>
<tr>
<td>Controls: Integral with Equipment Directly Applied to Ducts, Pipes, etc.</td>
<td>15</td>
<td>15</td>
<td>16</td>
<td>15</td>
</tr>
<tr>
<td>Valve Motors, Damper Motors, Solenoid Valves, etc.</td>
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<td>15</td>
<td>-</td>
<td>15</td>
</tr>
<tr>
<td>EP Valves or Switches, P.E. Switches, etc.</td>
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<td>15</td>
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</tr>
<tr>
<td>Control Circuit Outlets</td>
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<tr>
<td>Fire Alarm Systems</td>
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<tr>
<td>Fire Sprinkler Alarm</td>
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<tr>
<td>Firestats</td>
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<tr>
<td>Smoke Detectors Including Relays Fan Control</td>
<td>16</td>
<td>16</td>
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<td>16</td>
</tr>
<tr>
<td>Control Air Compressor</td>
<td>15</td>
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<td>16</td>
<td>15</td>
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<tr>
<td>Refrigerated Air Dryer</td>
<td>15</td>
<td>15</td>
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<td>15</td>
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<tr>
<td>Equipment Interlocks</td>
<td>15</td>
<td>15</td>
<td>-</td>
<td>15</td>
</tr>
<tr>
<td>Boiler and Water Heaters</td>
<td>15</td>
<td>15</td>
<td>16</td>
<td>15</td>
</tr>
</tbody>
</table>

**NOTES:**

1. If furnished as part of factory wired equipment furnished and set in place under Division 15, wiring and connections under Division 16.

2. If float switches, line thermostats, P.E. switches, time switches, or other controls carry the FULL LOAD CURRENT to any motor, they shall be furnished under Division 15, but they shall be set in place and connected under Division 16 except that where such items are an integral part of the mechanical equipment, or directly attached to ducts, piping, or other mechanical equipment, they shall be set in place under Division 15 and
connected under Division 16. If they do not carry the FULL LOAD CURRENT to any motor, they shall be furnished, set in place and wired under Division 15.
C. **Control Wiring:** Consists of wiring in pilot circuits of contact or starters, sensors, controllers, and relays, and wiring for valve and damper operators.
   1. **Connections:** Connections to all controls directly attached to ducts, piping and mechanical equipment shall be made with flexible connections.

D. **Starters:** Provide magnetic starters for all three phase motors and equipment complete with:
   1. Control transformers.
   2. 120V holding coils.
   3. Integral hand-off-auto switch.
   4. Auxiliary contacts required for system operation plus one (1) spare.

E. **Remote Switches and Push Button Stations:** Provide all remote switches and/or push button stations required for manually operated equipment (if no automatic controls have been provided) complete with pilot lights of an approved type lighted by current from load side of starter.

F. **Special Requirements:** Motors, starters and other electrical equipment installed in moist areas or areas of special conditions, such as explosion proof, shall be designed and approved for installation in such areas with appropriate enclosure.

G. **Identification:** Provide identification of purpose for each switch and/or push button station furnished. Identification may be either engraved plastic sign or permanent mounting to wall below switch, or stamping on switch cover proper. All such identification signs and/or switch covers in finished areas shall match other hardware in the immediate areas.

H. **Control Voltage:**
   1. Maximum allowable control voltage 120V. Fully protect control circuit conductors in accordance with National Electrical Code.
   2. Provide 20A breakers in emergency panels under Division 16 as required for Building Management System Air Temperature Controls (BMS/ATC). Provide all control transformers, control wiring and connections to circuits under Section 15950 of Division 15.

I. **Related Requirements**
   1. Section 16480: Electric Motors
      a. Coordinate with efficiency requirements.

J. Contractor must review all concrete embedded items (including conduit) with owner prior to placement.
PART 2 - PRODUCTS

2.01 MOTOR HORSEPOWER

A. In general, all motors 1/2 HP and above shall be three phase, all motors less than 1/2 HP shall be single phase.

B. Voltage and phase of motors as scheduled on the electrical drawings shall take precedence in the case of a conflict between the mechanical and electrical drawings or General Condition 2.01 A., above.

C. Work under Division 15 includes coordinating the electrical requirements of all mechanical equipment with the requirements of the work under Division 16, before ordering the equipment.

1. If motor horsepower is changed under the work of Division 15, without a change in duty of the motor's driven device, coordination of additional electrical work (if any) and additional payment for the work (if any) shall be provided under the section of Division 15 initiating the change. Increases or decreases in motor horsepower from that specified shall not be made without written approval from the Engineer.

PART 3 - EXECUTION

NOT USED.

END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: This section establishes general requirements in addition to those indicated in the General Conditions of the Contract for Construction pertaining to cutting, fitting, and patching of the work required to:
   1. Make the several parts fit properly.
   2. Uncover work to provide for installation, inspection, or both, of ill-timed work.
   3. Remove and replace work not conforming to requirements of Contract Documents.
   4. Patch new construction into existing construction.

B. Related Work:
   1. In addition to requirements specified, upon the Consultant's request, uncover work to provide for inspection of covered work, and remove samples of installed materials for testing.
   2. Do not cut or alter work performed under separate contract without the Consultant's written permission.

1.02 QUALITY ASSURANCE

A. Perform all cutting and patching in strict accordance with pertinent requirements of the Specifications and, in the event no such requirements are determined, in conformance with the Consultant's written direction.
   1. Use skilled workmen to perform all cutting and patching work.
   2. Use methods least likely to damage existing surfaces and materials to remain, while providing proper surfaces to receive installation of repair, patching, and/or new work.

B. Visual Quality:
   1. Do not cut and patch work exposed to public view, and the exterior and/or interior of the building in a manner that will result in an unacceptable appearance as determined by the Consultant.
   2. Do not cut and patch work in a manner that will result in obvious appearance that cutting and patching work was done.
   3. When cutting existing structural concrete, do not extend saw cuts beyond the corners of the required opening on either side of the opening.

1.03 EXISTING CONSTRUCTION

A. Where cutting and patching of existing construction is required; prior to start of work, inform Owner of existing construction to be disturbed. Owner will determine if elements of existing construction contain asbestos. Do not proceed with work until after Owner has examined areas to be disturbed. Refer to Exhibit A, Project Pre-Inspection for Possible Presence of Asbestos for additional information concerning the possible presence of materials containing asbestos.

1.04 SUBMITTALS

A. Submit proposed cutting and patching procedures in writing for the following categories of work prior to proceeding with this work:
1. Cutting new openings in existing structural concrete walls, parapets, and suspended slabs.
2. Cutting new openings in existing roofs and roofing materials.

B. Submittals shall comply with Section 01300.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Except as otherwise indicated in pertinent sections of these specifications, or as directed by the Consultant, use materials which are identical to existing materials in workmanship, appearance, and performance.

B. If identical materials are not available, match existing as closely as possible, especially existing visual characteristics.

PART 3 - EXECUTION

3.01 INSPECTION

A. Before proceeding, inspect existing conditions, including elements subject to movement or damage during cutting, excavating, backfilling, and patching.

B. After uncovering the work, inspect conditions affecting installation of new work.

C. If uncovered conditions are not as anticipated or if existing construction is not as indicated on the Drawings, immediately notify the Consultant for further instructions.

3.02 PREPARATION

A. Provide shoring, bracing, and support as required to maintain structured integrity of the project.

B. Take all necessary action required to protect adjacent existing surfaces from damage due to the work of this section.

C. Take all precautions necessary to protect existing surfaces and materials, new work, and the work of this section from damage due to adverse weather conditions.

D. Provide temporary support of work to cut and adjacent work to prevent failure or damage due to the work of this section.

E. Properly prepare substrate surfaces exposed during cutting as required to receive the work of this or other sections of these specifications in strict compliance with manufacturer's recommendations and these specifications.
3.03 EXECUTION

A. Perform all required cutting and patching as required or reasonably implied under pertinent sections of these specifications.

B. Perform cutting and demolition by methods which will prevent damage to other portions of the work and will provide proper finished installation complying with the specified tolerances and finishes.

3.04 PERFORMANCE

A. Execute cutting and demolition by methods which will prevent damage to other work, and will provide proper surfaces to receive installation of repairs and new work. Saw-cut and otherwise isolate areas to be demolished.

B. Repair or otherwise rebuild and/or construct all surfaces affected by cutting and demolition. Execute fitting and adjustment of products to provide totally finished installation to comply with tolerances, finishes, and profiles of adjacent surfaces, whether new or existing.

C. Restore work which has been cut or exposed by demolition; install new construction in compliance with specifications for type of new work to be done or as required to match existing adjacent surfaces. In no case shall any exposed existing surface be left in a raw, marred, or unfinished surface.

D. Refinish entire surfaces as necessary to provide an even finish.
   1. Continuous Surfaces: To nearest intersections.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS:
   A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 - Specification sections, apply to work of this section.

1.02 SUMMARY:
   A. Section Includes:
      1. General administrative requirements and procedures and related applicable codes.

1.03 APPROVAL AND RECOMMENDATION AGENCIES:
   A. The University of Colorado at Boulder has jurisdiction for the interpretation and enforcement of code requirements for construction of projects.

1.04 CODES:
   A. All Contractors shall comply with all applicable codes, ordinances and regulations in effect at the time of bid openings.

APPROVED STATE BUILDING CODES

The following approved building codes and standards have been adopted by State Buildings Programs (SBP) as the minimum requirements to be applied to all state-owned buildings and physical facilities including capital construction and controlled maintenance construction projects.

(as adopted by the Colorado State Buildings Program as follows: Chapter 1 as amended, Chapters 2-35 and Appendices C and I)

The 2009 edition of the International Mechanical Code (IMC)
(as adopted by the Colorado State Buildings Program as follows: Chapters 2-15 and Appendix A)

(as adopted by the Colorado State Buildings Program)

The 2011 edition of the National Electrical Code (NEC)
(National Fire Protection Association Standard 70) (as adopted by the Colorado State Electrical Board)

The 2009 edition of the International Plumbing Code (IPC)
(as adopted by the Colorado Examining Board of Plumbers as follows: Chapter 1 Section 101.2,102, 105, 107, Chapters 2-13 and Appendices B, D, E, F and G)

The 2009 edition of the International Fuel Gas Code (IFGC)
(as adopted by the Colorado Examining Board of Plumbers as follows: Chapter 1 Section 101,102, 105, 107, Chapters 2-8 and Appendices A, B, and C)
The National Fire Protection Association Standards (NFPA)
(as adopted by the Department of Public Safety/Division of Fire Safety as follows with editions shown in
NFPA-45 (latest edition)

The 2007 edition of the ASME Boiler and Pressure Vessel Code
(as adopted by the Department of Labor and Employment/Boiler Inspection Section as follows: sections I,
IV, VIII-Divisions 1 and 2 and 3, X and B31.1)

The 2007 edition of the National Boiler Inspection Code (NBIC)
(as adopted by the Department of Labor and Employment/Boiler Inspection Section)

The 2006 edition of the Controls and Safety Devices for Automatically Fired Boilers CSD-1
(as adopted by the Department of Labor and Employment/Boiler Inspection Section)

(as adopted by the Department of Labor and Employment/Boiler Inspection Section)

The 2007 edition of ASME A17.1 Safety Code for Elevators and Escalators
(as adopted by the Department of Labor and Employment/Conveyance Section and as amended by
ASME International)

The 2005 edition of ASME A17.3 Safety Code for Existing Elevators and Escalators
(as adopted by the Department of Labor and Employment/Conveyance Section and as amended by
ASME International)

The 2005 edition of ASME A18.1 Safety Standard for Platform Lifts and Stairway Chairlifts
(as adopted by the Department of Labor and Employment/Conveyance Section and as amended by
ASME International)

The current edition of the Rules and Regulations Governing the Sanitation of Food Service
Establishments
(as adopted by the Department of Public Health and Environment/Colorado State Board of Health)

(as adopted by the Colorado General Assembly as follows: CRS 9-5-101, as amended, for accessible
housing)

Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG)

Note: Additional codes, standards and appendices may be adopted by the state agencies and institutions
in addition to the minimum codes and standards herein adopted by State Buildings Programs.

1. The 2009 edition of the IBC became effective on July 1 of 2010. Consult the state electrical and
   plumbing boards and the state boiler inspector and conveyance administrator and the Division of
   Fire Safety for adoption of current editions and amendments to their codes.
2. Projects should be designed and plans and specifications should be reviewed based upon the approved codes at the time of A/E contract execution. If an agency prefers to design to a different code such as a newer edition of a code that State Buildings Programs has not yet adopted, the agency must contact SBP for approval and then amend the A/E contract with a revised Exhibit C, Approved State Building Codes. Please note that the state plumbing and electrical boards enforce the editions of their codes that are in effect at the time of permitting not design.

3. The state’s code review agents, or the State Buildings Programs approved agency building official, shall review all documents for compliance with the codes stipulated herein. Note: The Department of Public Health and Environment, Division of Consumer Protection will review drawings for food service related projects.

4. This policy does not prohibit the application of various life safety codes as established by each agency for specific building types and funding requirements. NFPA 101 and other standards notwithstanding, approved codes will supersede where their minimum requirements are the most restrictive in specific situations. If a conflict arises, contact State Buildings Programs for resolution.

5. It is anticipated that compliance with the federal Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG) and Colorado Revised Statutes Section 9-5-101 will be met by compliance with the 2009 International Building Code and ICC/ANSI A117.1. However, each project may have unique aspects that may require individual attention to these legislated mandates.

6. The 2006 edition of the International Building Code (IBC) is to be applied to factory-built nonresidential structures as established by the Division of Housing within the Department of Local Affairs.

A. Appendices

Appendices are provided to supplement the basic provisions of the codes. Approved IBC Appendices are as follows:

1. Mandatory
   IBC Appendix Chapter C - Agricultural Buildings
   IBC Appendix Chapter I - Patio Covers

2. Optional
   Any non-mandatory appendix published in the International Building Code may be utilized at the discretion of the agency. Use of an appendix shall be indicated in the project code approach.

B. Amendments

International Building Code, Chapter 1 as amended
By State of Colorado.

C. Referenced Codes

1. While not adopted in entirety, portions of the following codes are referenced in the International Building Code (IBC), the International Mechanical Code (IMC), the International
Energy Conservation Code (IECC) the International Plumbing Code (IPC), and the International Fuel Gas Code (IFGC). These following codes would be applied as reference standards.

2009 International Fire Code (IFC)
2009 International Existing Building Code (IEBC)

D. **Referenced Standards**

The IBC, IMC, IECC, IPC and IFGC standards shall be utilized to provide specific, or prescriptive, requirements on how to achieve the requirements established in the code. These standards may be unique to the code or may be derived from other established industry standards. Recognized standards may also be used to show compliance with the standard of duty established by the code.

**CHAPTER 1**

**SCOPE AND ADMINISTRATION**

**PART 1—SCOPE AND APPLICATION**

**SECTION 101  GENERAL**

101.1 **Title.** These regulations shall be known as the *Building Code* of the Department of Personnel & Administration/Office of the State Architect (DPA/OSA), hereinafter referred to as “this code”.

101.2 **Scope.** The provisions of this code shall apply to the construction, alteration, movement, enlargement, replacement, repair, equipment, use and occupancy, location, maintenance, removal and demolition of every building or structure or any appurtenances connected or attached to such buildings or structures.

**Exception:** Detached one- and two-family *dwellings* and multiple single-family *dwellings* (townhouses) not more than three stories above grade plane in height with a separate *means of egress* and their accessory structures shall comply with the *International Residential Code*.

101.2.1 **Appendices.** Provisions in the appendices shall not apply unless specifically adopted.

101.3 **Intent.** The purpose of this code is to establish the minimum requirements to safeguard the public health, safety and general welfare through structural strength, *means of egress* facilities, stability, sanitation, adequate light and ventilation, energy conservation, and safety to life and property from fire and other hazards attributed to the built environment and to provide safety to fire fighters and emergency responders during emergency operations.

101.4 **Referenced codes.** The other codes listed in Sections 101.4.1 through 101.4.6 and referenced elsewhere in this code shall be considered part of the requirements of this code to the prescribed extent of each such reference.

101.4.1 **Gas.** The provisions of the *International Fuel Gas Code* shall apply to the installation of gas piping from the point of delivery, gas appliances and related accessories as covered in this code. These requirements apply to gas piping systems extending from the point of delivery to the inlet connections of appliances and the installation and operation of residential and commercial gas appliances and related accessories.

101.4.2 **Mechanical.** The provisions of the *International Mechanical Code* shall apply to the installation, alterations, repairs and replacement of mechanical systems, including equipment, appliances, fixtures, fittings and/or appurtenances, including ventilating, heating, cooling, air-conditioning and refrigeration systems, incinerators and other energy-related systems.

101.4.3 **Plumbing.** The provisions of the *International Plumbing Code* shall apply to the installation, alteration, repair and replacement of plumbing systems, including equipment, appliances, fixtures, fittings and appurtenances, and where connected to a water or sewage system and all aspects of a medical gas system.
101.4.6 Energy. The provisions of the International Energy Conservation Code shall apply to all matters governing the design and construction of buildings for energy efficiency.

SECTION 102
APPLICABILITY

102.1 General. Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall be applicable. Where, in any specific case, different sections of this code specify different materials, methods of construction or other requirements, the most restrictive shall govern.

102.2 Other laws. The provisions of this code shall not be deemed to nullify any provisions of local, state or federal law.

102.3 Application of references. References to chapter or section numbers, or to provisions not specifically identified by number, shall be construed to refer to such chapter, section or provision of this code.

102.4 Referenced codes and standards. The codes and standards referenced in this code shall be considered part of the requirements of this code to the prescribed extent of each such reference. Where differences occur between provisions of this code and referenced codes and standards, the provisions of this code shall apply.

102.5 Partial invalidity. In the event that any part or provision of this code is held to be illegal or void, this shall not have the effect of making void or illegal any of the other parts or provisions.

102.6 Existing structures. The legal occupancy of any structure existing on the date of adoption of this code shall be permitted to continue without change, except as is specifically covered in this code or as is deemed necessary by DPA/OSA through its code review agent for the general safety and welfare of the occupants and the public.

PART 2—ADMINISTRATION AND ENFORCEMENT

SECTION 104
DUTIES AND POWERS OF BUILDING OFFICIAL

104.1 General. DPA/OSA as the building official is hereby authorized and directed to enforce the provisions of this code. DPA/OSA shall have the authority to render interpretations of this code and to adopt policies and procedures in order to clarify the application of its provisions. Such interpretations, policies and procedures shall be in compliance with the intent and purpose of this code. Such policies and procedures shall not have the effect of waiving requirements specifically provided for in this code.

104.2 Plan reviews. DPA/OSA through its code review agent shall review construction documents and issue compliance notices for the erection, and alteration, demolition and moving of buildings and structures and inspect the premises for which such compliance notices have been issued.

104.4 Inspections. DPA/OSA through its code review agent shall make all of the required inspections, or DPA/OSA shall have the authority to accept reports of inspection by approved agencies or individuals. Reports of such inspections shall be in writing and be certified by a responsible officer of such approved agency or by the responsible individual. DPA/OSA is authorized to engage such expert opinion as deemed necessary to report upon unusual technical issues that arise.

104.9 Approved materials and equipment. Materials, equipment and devices approved by DPA/OSA through its code review agent shall be constructed and installed in accordance with such approval.

104.10 Modifications. Wherever there are practical difficulties involved in carrying out the provisions of this code, DPA/OSA shall have the authority to grant modifications for individual cases, upon application of the owner or owner’s representative, provided DPA/OSA shall first find that special individual reason makes the strict letter of this code impractical and the modification is in compliance with the intent and purpose of this code and that such modification does not lessen health, accessibility, life and fire safety, or structural requirements. The details of action granting modifications shall be recorded and entered in the files of DPA/OSA.

104.11 Alternative materials, design and methods of construction and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where DPA/OSA through its code review agent finds that the proposed design is
satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety.

104.11.1 Research reports. Supporting data, where necessary to assist in the approval of materials or assemblies not specifically provided for in this code, shall consist of valid research reports from approved sources.

104.11.2 Tests. Whenever there is insufficient evidence of compliance with the provisions of this code, or evidence that a material or method does not conform to the requirements of this code, or in order to substantiate claims for alternative materials or methods, DPA/OSA through its code review agent shall have the authority to require tests as evidence of compliance to be made at no expense to the jurisdiction. Test methods shall be as specified in this code or by other recognized test standards. In the absence of recognized and accepted test methods, DPA/OSA through its code review agent shall approve the testing procedures. Tests shall be performed by an approved agency.

SECTION 105
PLAN REVIEWS

105.1 Required. Any owner or authorized agent who intends to construct, enlarge, alter, repair, move, demolish, or change the occupancy of a building or structure, or to erect, install, enlarge, alter, repair, remove, convert or replace any electrical, gas, mechanical or plumbing system, the installation of which is regulated by this code, or to cause any such work to be done, shall first contact a DPA/OSA code review agent.

105.2 Work exempt from plan review. Exemptions from plan review requirements of this code shall not be deemed to grant authorization for any work to be done in any manner in violation of the provisions of this code or any other laws or ordinances of this jurisdiction. Plan review shall not be required for the following:

Building:

1. One-story detached accessory structures used as tool and storage sheds, playhouses and similar uses, provided the floor area does not exceed 120 square feet (11 m2).
2. Fences not over 6 feet (1829 mm) high.
3. Oil derricks.

4. Retaining walls that are not over 4 feet (1219 mm) in height measured from the bottom of the footing to the top of the wall, unless supporting a surcharge or impounding Class I, II or IIIA liquids.
5. Water tanks supported directly on grade if the capacity does not exceed 5,000 gallons (18 925 L) and the ratio of height to diameter or width does not exceed 2:1.
6. Sidewalks and driveways not more than 30 inches (762 mm) above adjacent grade, and not over any basement or story below and are not part of an accessible route.
7. Painting, papering, tiling, carpeting, cabinets, counter tops and similar finish work.
8. Temporary motion picture, television and theater stage sets and scenery.
9. Prefabricated swimming pools accessory to a Group R-3 occupancy that are less than 24 inches (610 mm) deep, do not exceed 5,000 gallons (18 925 L) and are installed entirely above ground.
10. Shade cloth structures constructed for nursery or agricultural purposes, not including service systems.
11. Swings and other playground equipment accessory to detached one- and two-family dwellings.
12. Window awnings supported by an exterior wall that do not project more than 54 inches (1372 mm) from the exterior wall and do not require additional support of Groups R-3 and U occupancies.
13. Nonfixed and movable fixtures, cases, racks, counters and partitions not over 5 feet 9 inches (1753 mm) in height.

Electrical:

Repairs and maintenance: Minor repair work, including the replacement of lamps or the connection of approved portable electrical equipment to approved permanently installed receptacles.

Radio and television transmitting stations: The provisions of this code shall not apply to electrical equipment used for radio and television transmissions, but do apply to equipment and wiring for a power supply and the installations of towers and antennas.

Temporary testing systems: A plan review shall not be required for the installation of any temporary system required for the testing or servicing of electrical equipment or apparatus.
Gas:

1. Portable heating appliance.
2. Replacement of any minor part that does not alter approval of equipment or make such equipment unsafe.

Mechanical:

1. Portable heating appliance.
2. Portable ventilation equipment.
3. Portable cooling unit.
4. Steam, hot or chilled water piping within any heating or cooling equipment regulated by this code.
5. Replacement of any part that does not alter its approval or make it unsafe.
6. Portable evaporative cooler.
7. Self-contained refrigeration system containing 10 pounds (5 kg) or less of refrigerant and actuated by motors of 1 horsepower (746 W) or less.

Plumbing:

1. The stopping of leaks in drains, water, soil, waste or vent pipe, provided, however, that if any concealed trap, drain pipe, water, soil, waste or vent pipe becomes defective and it becomes necessary to remove and replace the same with new material, such work shall be considered as new work and a plan review shall be obtained and inspection made as provided in this code.
2. The clearing of stoppages or the repairing of leaks in pipes, valves or fixtures and the removal and reinstallation of water closets, provided such repairs do not involve or require the replacement or rearrangement of valves, pipes or fixtures.

105.2.1 Emergency repairs. Where equipment replacements and repairs must be performed in an emergency situation, plan review information shall be submitted promptly to DPA/OSA through its code review agent.

105.2.2 Repairs. Application or notice to DPA/OSA through its code review agent is not required for ordinary repairs to structures, replacement of lamps or the connection of approved portable electrical equipment to approved permanently installed receptacles. Such repairs shall not include the cutting away of any wall, partition or portion thereof, the removal or cutting of any structural beam or load-bearing support, or the removal or change of any required means of egress, or rearrangement of parts of a structure affecting the egress requirements; nor shall ordinary repairs include addition to, alteration of, replacement or relocation of any standpipe, water supply, sewer, drainage, drain leader, gas, soil, waste, vent or similar piping, electric wiring or mechanical or other work affecting public health or general safety.

105.2.3 Public service agencies. A plan review shall not be required for the installation, alteration or repair of generation, transmission, distribution or metering or other related equipment that is under the ownership and control of public service agencies by established right.

105.4 Validity of compliance notice. The issuance or granting of a compliance notice shall not be construed to be an approval of any violation of any of the provisions of this code or of any other ordinance of the jurisdiction. The issuance of a compliance notice based on construction documents and other data shall not prevent DPA/OSA through its code review agent from requiring the correction of errors in the construction documents and other data.

105.7 Placement of building inspection record. The building inspection record based on the compliance notice inspection recommendations shall be kept on the site of the work until the completion of the project.

SECTION 106
FLOOR AND ROOF DESIGN LOADS

106.1 Live loads posted. Where the live loads for which each floor or portion thereof of a commercial or industrial building is or has been designed to exceed 50 psf (2.40 kN/m²), such design live loads shall be conspicuously posted by the owner in that part of each story in which they apply, using durable signs. It shall be unlawful to remove or deface such notices.

106.2 Issuance of notice of approval of occupancy/use. A notice of approval of occupancy/use required by Section 111 shall not be issued until the floor load signs, required by Section 106.1, have been installed.

106.3 Restrictions on loading. It shall be unlawful to place, or cause or permit to be placed, on any floor or roof of a building, structure or portion thereof, a load greater than is permitted by this code.

SECTION 107
SUBMITTAL DOCUMENTS
107.1 General. Submittal documents consisting of construction documents, statement of special inspections, geotechnical report and other data shall be submitted. The construction documents shall be prepared by a registered design professional where required by the statutes of the state of Colorado. Where special conditions exist, DPA/OSA through its code review agent is authorized to require additional construction documents to be prepared by a registered design professional.

Exception: DPA/OSA is authorized to waive the submission of construction documents and other data not required to be prepared by a registered design professional if it is found that the nature of the work applied for is such that review of construction documents is not necessary to obtain compliance with this code.

107.2 Construction documents. Construction documents shall be in accordance with Sections 107.2.1 through 107.2.5.

107.2.1 Information on construction documents. Construction documents shall be dimensioned and drawn upon suitable material. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the provisions of this code and relevant laws, ordinances, rules and regulations.

107.2.2 Fire protection system shop drawings. Shop drawings for the fire protection system(s) shall be submitted to indicate conformance to this code and the construction documents and shall be approved prior to the start of system installation. Shop drawings shall contain all information as required by the referenced installation standards in Chapter 9.

107.2.3 Means of egress. The construction documents shall show in sufficient detail the location, construction, size and character of all portions of the means of egress in compliance with the provisions of this code. In other than occupancies in Groups R-2, R-3, and I-1, the construction documents shall designate the number of occupants to be accommodated on every floor, and in all rooms and spaces.

107.2.4 Exterior wall envelope. Construction documents for all buildings shall describe the exterior wall envelope in sufficient detail to determine compliance with this code. The construction documents shall provide details of the exterior wall envelope as required, including flashing, intersections with dissimilar materials, corners, end details, control joints, intersections at roof, eaves or parapets, means of drainage, water-resistive membrane and details around openings.

The construction documents shall include manufacturer’s installation instructions that provide supporting documentation that the proposed penetration and opening details described in the construction documents maintain the weather resistance of the exterior wall envelope. The supporting documentation shall fully describe the exterior wall system which was tested, where applicable, as well as the test procedure used.

107.2.5 Site plan. The construction documents submitted with the application for permit shall be accompanied by a site plan showing to scale the size and location of new construction and existing structures on the site, distances from lot lines, the established street grades and the proposed finished grades and, as applicable, flood hazard areas, floodways, and design flood elevations; and it shall be drawn in accordance with an accurate boundary line survey. In the case of demolition, the site plan shall show construction to be demolished and the location and size of existing structures and construction that are to remain on the site or plot. DPA/OSA through its code review agent is authorized to waive or modify the requirement for a site plan when the application for plan review is for alteration or repair or when other wise warranted.

107.2.5.1 Design flood elevations. Where design flood elevations are not specified, they shall be established in accordance with Section 1612.3.1.

107.3 Examination of documents. DPA/OSA through its code review agent shall examine or cause to be examined the accompanying submittal documents and shall ascertain by such examinations whether the construction indicated and described is in accordance with the requirements of this code and other pertinent laws or ordinances.

107.3.3 Phased approval. DPA/OSA through its code review agent is authorized to issue a compliance notice for the construction of foundations or any other part of a building or structure before the construction documents for the whole building or structure have been submitted, provided that adequate information and detailed statements have been filed complying with pertinent requirements of this code. The holder of such compliance notice for the foundation or other parts of a building or structure shall proceed at the
holder’s own risk with the building operation and without assurance that a compliance notice for the entire structure will be granted.

107.3.4 Design professional in responsible charge.

107.3.4.1 General. The registered design professional in responsible charge shall be responsible for reviewing and coordinating submittal documents prepared by others, including phased and deferred submittal items, for compatibility with the design of the building.

107.3.4.2 Deferred submittals. For the purposes of this section, deferred submittals are defined as those portions of the design that are not submitted at the time of the plan review and that are to be submitted to DPA/OSA through its code review agent within a specified period.

Deferral of any submittal items shall have the prior approval of DPA/OSA through its code review agent. The registered design professional in responsible charge shall list the deferred submittals on the construction documents for review by DPA/OSA through its code review agent.

Documents for deferred submittal items shall be submitted to the registered design professional in responsible charge who shall review them and forward them to DPA/OSA through its code review agent with a notation indicating that the deferred submittal documents have been reviewed and found to be in general conformance to the design of the building. The deferred submittal items shall not be installed until the deferred submittal documents have been approved by DPA/OSA through its code review agent.

107.4 Amended construction documents. Work shall be installed in accordance with the approved construction documents, and any changes made during construction that are not in compliance with the approved construction documents shall be resubmitted for approval as an amended set of construction documents.

SECTION 108
TEMPORARY STRUCTURES AND USES

108.1 General. DPA/OSA through its code review agent is authorized to issue a compliance notice for temporary structures and temporary uses. Such compliance notice shall be limited as to time of service, but shall not be permitted for more than 180 days. DPA/OSA through its code review agent is authorized to grant extensions for demonstrated cause.

108.2 Conformance. Temporary structures and uses shall conform to the structural strength, fire safety, means of egress, accessibility, light, ventilation and sanitary requirements of this code as necessary to ensure public health, safety and general welfare.

108.3 Temporary power. DPA/OSA through its code review agent is authorized to give permission to temporarily supply and use power in part of an electric installation before such installation has been fully completed and the final certificate of completion has been issued. The part covered by the temporary certificate shall comply with the requirements specified for temporary lighting, heat or power in NFPA 70.

SECTION 109
FEES

109.1 Payment of fees. Refer to DPA/OSA Building Code Compliance Policy.

SECTION 110
INSPECTIONS

110.1 General. Construction or work for which a plan review is required shall be subject to inspection by DPA/OSA through its code review agent and such construction or work shall remain accessible and exposed for inspection purposes until approved. Approval as a result of an inspection shall not be construed to be an approval of a violation of the provisions of this code or of other ordinances of the jurisdiction. Inspections presuming to give authority to violate or cancel the provisions of this code or of other ordinances of the jurisdiction shall not be valid. It shall be the duty of the holder of the notice to proceed to cause the work to remain accessible and exposed for inspection purposes. Neither DPA/OSA, its code review agent nor state agency shall be liable for expense entailed in the removal or replacement of any material required to allow inspection.

110.2 Preliminary inspection. Before issuing a compliance notice, DPA/OSA through its code review agent is authorized to examine or cause to be examined buildings, structures and sites for which an application has been filed.

110.3 Required inspections. DPA/OSA through its code review agent, upon notification, shall make the inspections set forth in Sections 110.3.1 through 110.3.10.
110.3.1 Footing and foundation inspection. Footing and foundation inspections shall be made after excavations for footings are complete and any required reinforcing steel is in place. For concrete foundations, any required forms shall be in place prior to inspection. Materials for the foundation shall be on the job, except where concrete is ready mixed in accordance with ASTM C 94, the concrete need not be on the job.

110.3.2 Concrete slab and under-floor inspection. Concrete slab and under-floor inspections shall be made after in-slab or under-floor reinforcing steel and building service equipment, conduit, piping accessories and other ancillary equipment items are in place, but before any concrete is placed or floor sheathing installed, including the subfloor.

110.3.3 Lowest floor elevation. In flood hazard areas, upon placement of the lowest floor, including the basement, and prior to further vertical construction, the elevation certification required in Section 1612.5 shall be submitted to DPA/OSA through its code review agent.

110.3.4 Frame inspection. Framing inspections shall be made after the roof deck or sheathing, all framing, fireblocking and bracing are in place and pipes, chimneys and vents to be concealed are complete and the rough electrical, plumbing, heating wires, pipes and ducts are approved.

110.3.5 Lath and gypsum board inspection. Lath and gypsum board inspections shall be made after lathing and gypsum board, interior and exterior, is in place, but before any plastering is applied or gypsum board joints and fasteners are taped and finished.

Exception: Gypsum board that is not part of a fire-resistance-rated assembly or a shear assembly.

110.3.6 Fire- and smoke-resistant penetrations. Protection of joints and penetrations in fire-resistance-rated assemblies, smoke barriers and smoke partitions shall not be concealed from view until inspected and approved.

110.3.7 Energy efficiency inspections. Inspections shall be made to determine compliance with Chapter 13 and shall include, but not be limited to, inspections for: envelope insulation $R$- and $U$-values, fenestration $U$-value, duct system $R$-value, and HVAC and water-heating equipment efficiency.

110.3.8 Other inspections. In addition to the inspections specified above, DPA/OSA through its code review agent is authorized to make or require other inspections of any construction work to ascertain compliance with the provisions of this code and other laws that are enforced by DPA/OSA.

110.3.9 Special inspections. For special inspections, see Section 1704.

110.3.10 Final inspection. The final inspection shall be made after all work required is completed.

110.4 Inspection agencies. DPA/OSA through its code review agent is authorized to accept reports of approved inspection agencies, provided such agencies satisfy the requirements as to qualifications and reliability.

110.5 Inspection requests. It shall be the duty of the holder of the notice to proceed or their duly authorized agent to notify DPA/OSA through its code review agent when work is ready for inspection. It shall be the duty of the notice to proceed holder to provide access to and means for inspections of such work that are required by this code.

110.6 Approval required. Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of DPA/OSA through its code review agent. The code review agent, upon notification, shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed, or notify the holder of the notice to proceed or his or her agent wherein the same fails to comply with this code. Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the code review agent.

SECTION 111
CERTIFICATE OF OCCUPANCY

111.1 Use and occupancy. No building or structure shall be used or occupied, and no change in the existing occupancy classification of a building or structure or portion thereof shall be made, until DPA/OSA has issued a notice of approval of occupancy/use therefor as provided herein. Issuance shall not be construed as an approval of a violation of the provisions of this code or of other ordinances of the jurisdiction.

Exception: Notices of approval of occupancy/use are not required for work exempt from plan review under Section 105.2.
111.3 Temporary occupancy. DPA/OSA is authorized to issue a temporary notice of approval of occupancy/use for discrete portions of work before the completion of the entire work provided that such portion or portions shall be occupied safely.
1.05 OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA):

A. The Contractor shall have sole responsibility for compliance on the job site to all applicable portions of the Occupational Safety and Health Act. The Contractor is responsible for other regulatory requirements as they relate to occupational Health and Safety requirements. For example, NIOSH, ANSI, and MSA.

B. Protection of life, health and public welfare as it relates to the execution of the construction contract is the responsibility of the Contractor. The Owner’s Representative may, at their discretion, observe, inspect, or comment on plans, procedures, or actions employed at the project as they relate to safety of life, health or public welfare. If conditions are imposed by the Owner which interfere with, or imply actions detrimental to safety, written notice shall be returned to the Owner for action prior to affecting any unsafe conditions.

C. Contractors shall use OSHA Lock Out / Tag Out procedures when working with energized equipment.

D. All contractors entering confined spaces owned by CU or while conducting work under contract with CU shall develop a written program and utilize procedures that, at a minimum, comply with all federal, state and local confined space standards and all applicable regulatory requirements. Contractors shall, independent of the University, monitor the space to obtain their own data to ensure a safe entry and exit. Any data generated by a contractor’s confined space entry, should be provided to the Facilities Management confined Space Program Manager.

E. When contractors perform work that may involve Facilities Management controlled permit required confined spaces, Facilities Management will:
   1. Inform contractors of permit required confined spaces and that entry is allowed only after compliance with the confined space entry standard;
   2. Require contractors planning to enter a confined space to provide the Facilities Management Confined Space Program Manager in charge of that space, 48-hour advance notice of such planned entry. The contractors entry will be in accordance with the current Occupational Safety and Health Administration confined space entry standard and a signed document stating such, shall be provided to the FM Confined Space Program Manager prior to entry.

F. The FM Confined Space Program Manager, following receipt of notice of contractor planned entry, will:
   1. Apprise contractor of the hazards identified in the confined space and of any prior experience that is documented on the space;
   2. Appraise the contractor of any precautions or procedures that CU has implemented for the protection of workers in or near the confined space;
   3. Coordinate entry operations with the contractor when both Facilities Management and contractor personnel are working in or around the confined space;
   4. Debrief the contractor at the end of the entry operations regarding hazards confronted or created.

1.06 HOT WORK PERMITS

A. All contractors shall be required to obtained a Hot Work Permit, three (3) working days in advance, for work that involves welding, heat treating, grinding, thawing pipe, hot riveting, soldering and brazing, power driven fasteners and similar activities involving spark, flame or heat. Compliance with the requirements of the applicable fire code, the International Building Code, and NFPA Standard 51B are mandatory and all contractors performing hot work activities shall read and understand these code requirements. To obtain a current Hot Work Permit, go to website:
http://fm.colorado.edu/firesafety/hotwork.html
B. Contractors shall read and comply with the procedures and requirements for Fire Watch, Fire Alarm Interruption and Fire Suppression Interruption as found on the following websites:

Fire Watch Procedures:  
http://fm.colorado.edu/firesafety/firewatch.html

Fire Alarm and Detection System Interruption/Outage:  
http://fm.colorado.edu/firesafety/firealarmdetectsys.html

Fire Suppression System Interruption/Outage:  
http://fm.colorado.edu/firesafety/firesuppressionsystems.html

C. No hot work shall be conducted in any campus facility without a hot work permit. Any person or firm who conducts hot work without a permit shall be fined one thousand dollars ($1,000) for each occurrence and their non-permitted activities shall be stopped immediately until they obtain a hot work permit. Contractor shall be responsible for any damages caused as a result of improper hot work activities or the work stoppage.

D. Individuals or firms who obtain a permit shall fully read, understand and implement the requirements of the permit. Any person or firm who conducts hot work without the full implementation of the permit requirements shall be fined five hundred dollars ($500) the first time and one thousand dollars ($1,000) for subsequent occurrences. When the requirements of the hot work permit are not being implemented, the improper activities shall be stopped immediately until a hot work permit is obtained. Contractor shall be responsible for any damages caused as a result of improper hot work activities or the work stoppage. Any contractor who is found to be in non-compliance a third time, will not be allowed to work on campus until further notice by Facilities Management.

E. The campus inspectors, project managers and fire marshal shall have the authority to stop improper or non-permitted hot work activities.

F. The Contractor shall notify the CU Fire Alarm Supervisor to deactivate all smoke alarms in the vicinity of the work prior to any demolition and construction work activity. Failure of the Contractor to comply with the smoke alarm deactivation requirement and cause a false alarm and arrival of the Boulder Fire Department shall be a $400 fine per occurrence.

1.07 PERMITS

A. The contractor must obtain a no fee building permit prior to starting work from Office Manager, Facilities Management at (303) 492-2904 in the Planning, Design and Construction Office, Research Laboratory No. 2, 1540 30th Street, Boulder, Colorado. Building permits are required on all projects except the following:

1. Fences not over 6 feet high & general landscape work
2. Retaining walls which are not over 4 feet in height, unless supporting a surcharge of impounding Class I, II or III-A liquids
3. Platforms, walks and driveways not more than 30 inches above grade and not over any basement or story below.
4. Painting, papering, and similar finish work that meet the requirements of chapter 8 of UBC. (Uniform Building Code).
5. Temporary motion picture, television and theater stage sets and scenery. Review for fire-safety issues is required.

B. The contractor must post the permit(s) in a prominent location at the jobsite including all inspection reports. The contractor shall have an updated set of contract documents available at the jobsite for all inspections.
1.08 INSPECTIONS

A. The Contractor must schedule all required inspections 48 hours in advance by calling (303) 492-2922. CU or their designated inspectors will complete these inspections within 48 hours with the exception of weekends and state holidays.

B. The contractor is required to arrange for the following inspections:
   1. Required inspections: General. Reinforcing steel or structural framework of any part of any building of structure shall not be covered or concealed without first obtaining the approval of the building official.
   2. Lath or gypsum board inspection: To be made after lathing and gypsum board, interior and exterior, is in place, but before any plastering is applied or before gypsum board joints and fasteners are taped and finished.
   3. Final inspection: To be made after finish grading and the building is completed and ready for occupancy.
   4. Special inspection: Special inspection may be required on special projects and special types of construction.
   5. Re-inspections: A re-inspection fee may be assessed for each inspection or reinspection when such portion of work for which inspection is called is not complete or when corrections called for are not made.

C. The Contractor will be responsible for all cost related to re-inspections and will be billed at a rate of $50.00 per hour for CU re-inspections and at the testing agency bill-out rate for other re-inspections.

1.09 UNIVERSITY OF COLORADO SEXUAL HARASSMENT POLICY

A. Contractors should be aware of and review the University of Colorado at Boulder’s policies that prohibit discrimination and harassment on the basis of race, color, national origin, sex, age, disability, creed, religion, sexual orientation or veteran status. These policies are located on the web at: http://www.colorado.edu/odh/ Contractor personnel must adhere to these policies and conduct themselves in a manner that does not discriminate or harass as a result of interacting with an around the University of Colorado faculty, staff and students and visitors.

1.10 FIRE ALARM INTERRUPTION

A. Contractor shall contact CU Fire Alarm Systems Supervisor at 303-492-0633 prior to all interruptions or shutdowns of fire alarm systems. Interruptions or shutdowns shall be scheduled three (3) working days in advance with CU Fire Alarm Systems Shop, CU Project Manager and building proctor. Contractor shall provide a fire watch as directed by CU Fire Alarm Systems Shop during interruption or shutdown.

B. The Contractor shall be responsible for preventing nuisance alarm due to activities at their work site. Common sources of nuisance alarms are:
   1. Smoke (soldering, welding, cooking, etc.)
   2. Grinding
   3. Dust (drilling, sweeping, canister vacuums, sand blasting, etc.)
   4. Water leaking (plumbing leaks, overflows)
   5. Water sprayed on or near detectors (pressure washing or cleaning with water)
   6. Popcorn or other food burning in microwaves
   7. Static electricity (covering or uncovering detectors)
   8. Changing filters on air handling units (dust)
   9. Steam (leaks, pressure pop-offs)
  10. Broken or frozen sprinkler heads
  11. Sprinkler drain valves turned by mistake
12. Vandalism
Precautions to prevent nuisance alarms are:

1. During construction projects, treat all buildings, except totally new construction, as though they were occupied buildings with live systems.
2. Do not assume that all detectors are in plain sight. Contact University personnel for verification.
3. Maintain dust control measures per UCB Standards:
   a. Maintaining barriers
   b. Covering air returns
   c. Asking CU personnel to cap or disable smoke detectors (Note any capping or disabling of fire safety devices is to be done ONLY by CU personnel, not contractors.)
   d. Avoiding recirculation of dust or smoke through the building air handling system.
4. Follow campus hot work procedures. Refer to specification Section 01060, paragraph 1.06.
3. Do not expose fire alarm devices to water or extreme temperatures.
4. Contact Fire Systems Group for any actions that affect fire detection, alarm, and suppression systems.

1.11 STORMWATER MANAGEMENT PLAN (SWMP)

A. Stormwater Management Plan (SWMP): Prior to any construction activity disturbing one acre of land or more, an approved SWMP and a Stormwater Permit for Construction Activity application from the Colorado Department of Public Health and Environment (CDPHE) are required. The SWMP shall be prepared in accordance with the CDPHE requirements for “Contents of the Stormwater Management Plan” and the UDFCD’s Urban Storm Drainage Criteria Manual, Volume 3, “Best Management Practices” (UDFCD Drainage Criteria Manual). Stormwater quality management and erosion control measures are to be constructed and maintained in accordance with the SWMP and the UDFCD Drainage Criteria Manual.

1.12 ENVIRONMENTAL/STORMWATER POLLUTION PREVENTION

A. Contractors working on the UCB campus must comply with all applicable University, City, State and Federal environmental regulations and standards. The contractor shall keep material such as saw-cut slurry, drywall mud, grout and mortar, paint, sediment, and all other wastes and process water out of gutters, streets, storm drains and parking lots. The contractor shall also be responsible for proper disposal of all waste materials. Immediately notify 911, EH&S 303-492-6025 and project manager of accidental hazardous materials releases.

B. Contractors are required to locate drains or other water discharge points in the area of the project and provide measures to protect from illicit discharges, prior to construction activities. For assistance with determining where a drain leads to (storm vs. sanitary, especially floor drains), contact the Facilities Management service center at 303-492-5522.

C. The contractor shall be responsible for all costs associated with damages and clean-up as a result of contractor caused illicit discharges of process water or other materials into the storm water system. Also, in addition to any penalties or fines imposed by the City, State or Federal agencies, the contractor shall be fined one thousand dollars ($1,000) by UCB for the first time an incident occurs and may be put on probation from working on campus. The contractor will be prohibited from working on campus, until further notice by UCB, if they are found to be responsible for an illicit discharge a second time.
D. For the purpose of eliminating storm water pollution, the contractor shall implement effective Best Management Practices (BMPs). BMPs include general good housekeeping practices, appropriate scheduling of activities, operational practices, maintenance procedures and other measures to prevent the discharge of pollutants directly or indirectly to the storm water system. These BMPs shall be maintained for the duration of the contractor's work. Contractors are required to visit website: http://www.bouldercolorado.gov/www/pace/government/index.html for examples of BMP's that are applicable to project activities. The Contractor shall ensure that all applicable employees and sub-contractors who work on site are trained and comply with storm water pollution prevention methods and proper BMP’s.

E. In addition to the BMP’s the contractor will be required to sign an Environmental Responsibilities form for all projects. The contractor shall post a copy of this form on site, throughout the duration of the project, in a visible area for all workers to see. Also, the contractor will be required to fill out a Pre-Construction Water Quality Certification form indicating any/all potential discharges of process water, chemicals, de-watering, or other materials to sewer systems or landscape areas that are expected to result from project activities.

1.13 UTILITY LOCATES

Contractor MUST CALL 811 (or 1-800-922-1987) for utility locates BEFORE DIGGING on any project at the University of Colorado at Boulder. This includes even small projects such as, but not limited to, planting trees or shrubs, sidewalk removal/installation or fence post installation. Digging without calling can disrupt service to the campus or surrounding neighborhoods and potentially result in fines and repair costs.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:
   1. Specification system format.
   2. Grammar (syntax) description.

1.02 DESCRIPTION

A. These specifications have been derived from automated specification systems, and include minor deviations from format and traditional writing forms. Such deviations must be recognized as a normal result of this production technique, and no other meaning will be implied or permitted.

B. Imperative language of the technical sections is directed to the Contractor. The term "provide" used repeatedly in the text is defined to mean..."furnish and install, complete, in place and ready for operation and use unless specifically indicated otherwise."

C. Specifications are of abbreviated, simplified or streamlined type and include incomplete sentences. Omissions of work or phrases such as "the Contractor shall", "in conformity therewith," "shall be," "as noted on the Drawings", "A", "The", are intentional. Supply omitted words or phrases by inference in same manner as they are when "Note" occurs on Drawings. Supply words "on the Drawings" by inference when "as indicated" is used with sentences or phrases.

PART 2 - PRODUCTS

Not used

PART 3 - EXECUTION

Not used

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Remodel Work scheduling.
   2. Construction sequence scheduling.

B. Related Sections:
   1. Section 01500 - Temporary Facilities and Controls.

1.02 SYSTEM DESCRIPTION

A. An essential condition of this Contract shall be the scheduling and conduct of all phases of construction operations in such a manner that the Owner's operations and use of the existing buildings and campus shall be uninterrupted at all times, except for such limited interruption as is required and approved by the owner.

B. Contractor shall repair at his own expense all damage done to Owner's property, unknown utilities and adjoining public property as a result of Contractor's construction activities.

1.03 PROJECT/SITE CONDITIONS

A. Access and use of site:
   1. Contractor shall use the designated site access for construction offices and material storage in such a manner that access to existing buildings and campus remain accessible at all times for use.
   2. Confine operations to as limited a use of the existing building and campus as possible. A route of access to and from the work for employees shall be agreed upon and it shall be the Contractor's responsibility to see that the agreed route is maintained in order to prevent unwarranted or unnecessary traffic through the existing buildings or site.

B. Owner notice and approval:
   1. All arrangements and scheduling in connection with the work of this Contract shall be made with and subject to the approval of the Consultant and the Owner.
   2. All work under this Contract which will require interruption of service of the existing building shall be scheduled to suit the need and convenience of the Owner's operation, and arrangements shall be made with the Owner and the Architect at least eight (8) working days in advance of the start of such work.

PART 2 - PRODUCTS

Not Used
PART 3 - EXECUTION

3.01 REMODELING

A. Construction activities of all areas to be constructed in existing facilities shall be completely separated from the rest of the building by dust-proof enclosures erected by Contractor.

B. All surfaces in existing facilities not indicated to be remodeled, or removal of existing items by any Contractor, shall be repaired by the responsible Contractor to match existing adjoining similar surfaces.

3.02 CLEAN-UP

A. All areas within existing facilities, which are not within enclosed areas to be constructed used for access to work areas shall be completely cleaned of all debris and made "broom-clean" at the end of each day's work.

B. Dust, which permeates areas of existing facilities because of improperly constructed dust-proof barriers, shall be the responsibility of the Contractor. The Contractor shall employ the services of a professional cleaning company to clean any area outside of the designated construction dust barriers that are contaminated by Contractor's operations. Completely clean all such areas to the satisfaction of the Owner at no additional cost.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS:
   A. Drawings and general provisions of the Contract, including General and Supplementary
      Conditions and other Division 1 - Specification sections, apply to work of this section.

1.02 SUMMARY:
   A. Section Includes:
      1. General administrative requirements and procedures for Hazardous Communication
         Program.
   B. Related Sections:
      1. Summary of Work: Section 01010.

1.03 WORK BY OWNER:
   A. Asbestos:
      1. The Owner has completed an Environmental Site Assessment to identify asbestos
         containing materials and other immediate Health and Safety items. Do not begin work
         until Form Exhibit A (copy following the Supplementary General Conditions) has been
         executed. Where asbestos materials or other hazardous conditions are known to exist in
         locations affected by this project, remediation measures will be taken by the Owner under
         separate contract. The Contractor shall coordinate his sequence and schedule with that
         of the environmental remediation work.
      2. In the event that the Contractor encounters any material on the site which is reasonably
         believed hazardous, which has not been rendered harmless, the Contractor shall:
            a. Stop work immediately in affected areas.
            b. Report the condition in writing to the Department of Facilities Management
               Project Administrator.
            c. Report the condition in writing to the Architect.
            d. Resume work only under the provisions of this section.

1.04 SUBMITTALS:
   A. Material Safety Data Sheets (MSDS):
      1. Copies of all material safety data sheets for all applicable products, including but not
         limited to; paint, adhesives, mastics, solvents, and finishes, etc., shall be retained on site
         by the Contractor for all applicable products used during the construction and/or
         remodeling work. Furnish copies of all MSDS’s to the Owner and Architect and include in
         the Project Record Document submittal.

1.05 QUALITY ASSURANCE:
   A. Asbestos containing materials may exist within the general project area where such materials are
      not expected to be disturbed during the work. The Contractor shall review the Environmental
      Health and Safety Environmental Site Assessment Form at the project site and become familiar
      with known asbestos and hazardous containing materials in the work areas.
A. Hazard Communication Requirements:

1. All Contractors are responsible for compliance with mandatory federal rules and regulations concerning Hazard Communication, including, but not limited to those regulations contained in 29 CFR 1910.1200 Hazard Communication, 1910.146 Confined Space, 1910.147 Lock-out Tag-out, 1910.1101 Asbestos, and 1926.62 Lead. Contractor and all subcontractors working at sites under the control of the Owner shall make available to the Architect, upon request, copies of the Hazard Communication Program used by their firm. In addition to this requirement, all regulations related to Multi-employer workplaces shall be adhered to. These regulations are found in 29 CFR 1910.1200, (e) (2) (I) through (e) (4) specifically:

   (e) (2) Multi-employer workplaces. Employers who produce, use, or store hazardous chemicals at workplace in such a way that employees of other employer(s) may be exposed (for example, employees of a construction contractor working on site) shall additionally ensure that the hazard communication programs developed and implemented under paragraph (e) include the following:

   (e) (2) (i) The methods the employer will use to provide the other employer(s) with a copy of the material safety data sheet, or to make it available at a central location in the workplace, for each hazardous chemical the other employer(s)' employees may be exposed to while working;

   (e) (2) (ii) The methods the employer will use to inform the other employer(s) of any precautionary measures that need to be taken to protect employees during the workplace's normal operating conditions and in foreseeable emergencies; and,

   (e) (2) (iii) The methods the employer will use to inform the other employer(s) of the labeling system used in the workplace

   (e) (3) The employer may rely on an existing hazard communication program to comply with these requirements, provided that it meets the criteria established in this paragraph (e).

   (e) (4) The employer shall make the written hazard communication program available, upon request, to employees, their designated representatives, the Assistant Secretary and the Director, in accordance with requirements of 29 CFR 1910.20 (e).

2. The referenced regulations were excerpted from 29 CFR 1910.1200. This excerpt shall not be relied upon for compliance with mandatory federal, state and local regulations. The Contractor shall comply with all such regulations and shall be solely liable for insuring that all requirements under applicable regulations are met.

PART 2 - PRODUCTS  (Not applicable)

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Asbestos and Hazardous Materials Discovery:

1. The Contractor is cautioned to be alert to the possibility that his work may uncover asbestos- containing or hazardous materials. If suspected materials are found, the Contractor shall notify the Owner and stop all work in the area immediately. If the
suspected materials prove to contain asbestos or hazardous materials, the Owner will arrange to have the materials abated in a timely manner.

3.02 HAZARDOUS MATERIALS/EQUIPMENT REMOVAL:

A. Definition:
   1. Removal of hazardous materials/equipment is extremely dangerous. Hazardous materials/equipment is defined to include, but not limited to the following:
      a. Fume hoods
      b. Hood exhaust duct work
      c. Exhaust fans
      d. Laboratory casework and equipment
      e. PCB ballast’s
      f. Mercury and Sodium Vapor Lights
      g. Adjacent material that could come in contact with workers or public.

B. Protection:
   1. Hazardous materials/equipment removal shall include the protection of personnel, material, environment and safe legal disposal of the equipment; and further includes the following:
      a. Notification of Project Administrator and appropriate Environmental Health and Safety Unit
      b. Proper protective clothing for personnel involved in the removal.
      c. Appropriate emergency and first aid facilities.
      d. Removal procedures shall be accomplished during minimal occupancy of the remainder of the building on the weekends or at night.

C. Disposal:
   1. All equipment related to the use, storage or processing of hazardous materials/equipment shall be removed and properly disposed of under the direct, full-time supervision of a qualified Laboratory Specialist fully conversant with the chemistry and properties of the material/equipment involved. Certification is required. Contractors are responsible for the removal of all hazardous materials/equipment and chemicals from the work site as well as proper disposal of all hazardous waste generated by their project.
   2. Hazardous waste disposal must include prior notification to the Department of Environmental Health and Safety in order to verify that the appropriate procedures and documentation are used. Copies of all paper work for shipping and disposing of these materials (hazardous waste manifests, land disposal restrictions, etc.) will be provided by the Contractor to the Department of Environmental Health & Safety (303) 492-6025. Where appropriate, the Main Campus EPF ID COD007431505 will be used for these shipments.
   3. Hazardous chemicals, waste, and other pollutants may not be discharged to the sanitary or storm sewer systems at anytime. Releases to the environment must be reported to CUPD/EH&S immediately.

END OF SECTION
PART 1 - GENERAL

1.01 REQUIREMENTS

A. The types and minimum requirements for project meetings are included but are not necessarily limited to the following categories:

Pre-construction meeting  
Progress and Coordination meetings  
Specially called meetings

B. The pre-construction meeting will be scheduled within fifteen days after date of Notice to Proceed, at a central site location designated by the Owner and convenient for all parties.

1. Attendance:
   a. Owner's Representative  
   b. Consultant and his sub-consultants, as applicable  
   c. Contractor's Superintendent  
   d. Major Subcontractor(s)  
   e. Others as appropriate

2. Suggested Agenda:
   a. Distribution and discussion of:
      i. List of major subcontractors and suppliers  
      ii. Projected construction schedules  
      iii. Critical work sequencing  
      iv. Major equipment deliveries and priorities  
      v. Project Coordination  
      vi. Designation of responsible personnel
   b. Procedures and processing of:
      i. Field decisions  
      ii. Proposal requests  
      iii. Submittals  
      iv. Change Orders  
      v. Applications for Payment  
   c. Adequacy of Distribution of Contract Documents  
   d. Procedure for Maintaining Record Documents  
   e. Inspections  
   f. Stormwater Management Plan (SWMP)

C. The Architect/Engineer will: Record the minutes; including significant proceedings and decisions.

D. The Contractor shall schedule and administer subcontractor and vendor pre-construction meetings throughout progress of the work. He will:

1. Prepare agenda for meetings.  
2. Distribute written notice of each meeting four days in advance of meeting date.  
3. Make physical arrangements for meetings.  
4. Preside at meeting.  
5. Record the minutes; including significant proceedings and decisions.  
6. Representatives of Contractors, Subcontractors, and Suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.
7. Use of Premises:
   Office, work, staging and storage areas
   Owner’s requirements

8. Temporary construction Facilities, Utilities, Controls and Construction Aids

9. Safety, First-aid, Security and Housekeeping Procedures

10. Administrative Procedures and Documents as Required by Owner

1.02 PROGRESS AND COORDINATION MEETING

The Contractor will schedule and administer job progress and coordination meeting at the site.

A. Attendance:
   1. Owner as needed
   2. Consultant and his sub-consultants as needed
   3. Subcontractor as appropriate to the agenda
   4. Suppliers as appropriate to the agenda
   5. Others

B. Suggested Agenda:
   1. Review of work progress since previous meeting.
   2. Field observations, problems and conflicts.
   3. Problems which impede Construction Schedule.
   4. Review of off-site fabrication and delivery schedules.
   5. Corrective measures and procedures to regain projected schedule.
   6. Revisions to Construction Schedule.
   7. Coordination of schedules.
   8. Progress and schedule during succeeding work period.
   9. Review submittal schedules and expedite as required.
   11. Pending changes and substitutions.
   12. Review proposed changes for:
       a. Effect on Construction Schedule and on completion date.
       b. Effect on other contracts of the Project.

C. The Architect/Engineer shall record and distribute the minutes of all progress meetings throughout the construction period and shall visit the site a minimum of once every two weeks. The Architect/Engineer shall average one visit per week during construction.

The structural engineer shall visit the site immediately prior to every major structural concrete slab pour; every major foundation wall pour; at least twice for each major segment of work [i.e., caissons, columns, steel roof joists, etc].

END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Submit shop drawings, product data and samples as required by various sections of the specifications.

1.02 QUALITY ASSURANCE

A. Shop Drawings:
1. Drawings shall be presented in a clear and thorough manner.
2. Details shall be identified by reference to sheet, detail, schedule, or room numbers shown on drawings.

B. Product Data:
1. Preparation:
   a. Clearly mark each copy to identify pertinent products or models.
   b. Show performance characteristics and capabilities.
   c. Show dimensions and clearances required.
   d. Show wiring or piping diagrams and controls.
2. Manufacturer's standard schematic drawings and diagrams.
   a. Modify drawings and diagrams to delete information that is not applicable to the work.
   b. Supplement Standard information to provide information specifically applicable to the work.

C. Samples:
1. Office samples shall be of sufficient size and quantity to clearly illustrate:
   a. Functional characteristics of the product with integrally related parts and attachment devices.
   b. Full range of color, texture and pattern.

D. Mock-ups:
1. Provide complete mock-up of exterior materials to be incorporated into the work.
   a. Mock-up shall include a sample of all materials used in exterior construction, whether specified elsewhere or not in these documents, including but not limited to, masonry, stone, window systems, precast concrete, roof systems, flashing, sealants, masonry paving, paint and other readily visible materials.
   b. Secure Owner approval of mock-ups prior to ordering and placement of materials. Modify mock-ups as directed by the Architect or Owner until acceptable.
   c. Confirm exact mock-up(s) required by Owner prior to fabrication of mock-up(s).
2. Remove mock-up at the conclusion of the project or when directed by the Architect.
   a. Restore or finish site to finish condition indicated on the Drawings.

E. Responsibilities of the Contractor:
1. Review shop drawings, product data, samples and project record drawings for specification performance prior to submission.
2. Determine and Verify:
   a. Field measurements
   b. Field construction criteria
   c. Catalog numbers and similar data
   d. Conformance with specifications
3. Coordinate each submittal with requirements of the work and of the Contract Documents.
4. Notify the Consultant in writing, at the time of submission, of any deviations in the submittals for requirements of the Contract Documents.
5. Begin no fabrication or work that requires submittals until return of submittals with Consultant's acceptance.
6. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved by Consultant's review of submittals.
7. Contractor shall stamp, sign or initial, and date each submittal to show compliance with the Contract Documents prior to submittal to the Consultant.

1.03 SUBMITTALS

A. Make submittals promptly in accordance with approved schedule and in such sequence as to cause no delay in the work.

B. Number of Submittals Required:
   1. Shop Drawings: Submit one reproducible transparency and four opaque reproductions. Three copies will be retained by the Consultant.
   2. Product Data: Submit seven copies, three of which will be retained by the Consultant.
   3. Samples: Submit the number stated in each specification section.

C. Submittals shall contain:
   1. Date of the submission and dates of any previous submissions.
   2. Project title and number.
   4. Names of:
      a. Contractor and Subcontractor(s), if applicable.
      b. Supplier
      c. Manufacturer
   5. Identification of product with the specification section number.
   6. Field dimensions, clearly identified as such.
   7. Relation to adjacent or critical features of the work or materials.
   8. Applicable standards, such as ASTM or Federal specification numbers.
   10. Identification of revisions on resubmittals.
   11. An 8"x3" blank space in lower right-hand corner for review stamps.

D. Resubmission Requirements:
   1. Make any corrections or changes in the submittals required by the Consultant and resubmit until accepted.
   2. Shop drawings and product data:
      a. Revise initial drawings or data and resubmit as specified for initial submittal.
      b. Indicate any changes that have been made, other than those requested by the Consultant.
3. Samples: Submit new samples as required for initial submittal.

E. Distribution:
   1. Distribute reproductions of approved shop drawings and copies of product data to affected subcontractors and retain one copy for use at the job-site.
   2. Distribute approved samples as directed.

F. Consultant's Duties:
   1. Review submittals with reasonable promptness and in accordance with schedule.
   2. Review of separate item does not constitute review of an assembly in which item functions.
   3. Affix stamp and initials or signature, and indicate requirements for resubmittal or acceptance of submittal.
   4. Return submittals to the Contractor for distribution or for resubmission.

G. Schedule of Values and pay applications:
   1. Submit typed schedule on State Form SC7.2; Contractor's standard form or media-driven printout will be considered on request.
   2. Format: Table of Contents of this Project Manual.
   3. Include in each line item a directly proportional amount of Contractor's overhead and profit.

H. Schedule of Submittals: The Contractor shall submit the submittals required by the specifications. The Contractor shall develop a submittal schedule that confirms the submittals and the time frame for review by the consultants.

I. Construction Schedule:
   1. The Contractor shall submit a critical-path method (CPM) construction schedule prior to start of construction activities. The CPM schedule shall include notice to proceed, submittal activities, construction activities, change order work (when applicable), close-out, testing, demonstration, and acceptance. The CPM shall correlate specifically to the schedule of values line items and be cost loaded.

   Float, slack time, or contingency within the schedule (i.e., the difference in time between the project's early completion date and the required contract completion date), and total float within the overall schedule, is not for the exclusive use of either the principal representative or the Contractor, but is jointly owned by both and is a resource available to and shared by both parties as needed to meet contract milestones and the contract completion date.

   The Contractor will be required to submit an as-built progress CPM schedule with each progress billing. This CPM schedule will be the basis for making progress payments. The level of detail and quantity of work activities in the CPM schedule should be negotiated with the principal representative prior to starting construction.

J. Progress Photos
   1. The Contractor shall submit up to 12 - 3x4 inch progress photos with each progress payment. The photos should demonstrate the work in place and be dated with a short description of the photographed item.
K. Coordination Drawings:
1. The Contractor shall submit coordination drawings with all mechanical, electrical, fire protection, and building monitoring systems prior to the Consultant review of any shop drawings or submittals for work in those trades. Approval of required shops and submittals must be obtained prior to starting work, and must be obtained prior to approval of pay applications of the work. The drawings shall be created to include all trades on a particular level of the building on one drawing. Identify conflicts between the systems or between the systems and architectural elements such as ceiling heights, ceiling types, or walls. Conduit routing for electrical, mechanical, energy management system, and security trades shall be included. Identify potential solutions to the conflicts for the Consultant and Owner to review during the submittal process. Revise the coordination drawings to show any comments made during the submittal review process, and reissue for use by all affected trades, Owner and Consultant.

2. The Coordination drawings shall include sectional coordination documents. Identify elevations of systems A.F.F. (above finish floor) and component dimensions. Show elevations whenever component changes height.

L. Daily Reports
1. The contractor shall submit daily reports, due by 5 p.m. the following day. The report should include weather, equipment, manpower count, subcontractors on site, short description of work for that day, inspections, visitors, items that may affect progress or quality of project.

M. Request for Information (RFI):
1. The Contractor will be responsible for submitting RFIs on AIA form G716 or similar. The RFI should identify in writing any unclear, inconsistent, or conflicting item in the documents that could not be answered by thorough review by the Contractor or subcontractors. The RFI should include a description of the item and a proposed solution. The RFI should indicate schedule or cost impact, if any. Contractor shall be required to submit cost or schedule impact within seven days of receipt of the RFI response. Each RFI shall be numbered in sequence.

N. Weekly Logs:
1. The Contractor shall provide an updated RFI, change request, and submittal logs at weekly construction meetings. Contractor shall provide a 2-week detailed construction schedule at the weekly construction meeting.

PART 2 - MATERIALS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION
PART 1 - GENERAL

1.01 SUPPLEMENTAL TESTING

If required, the following testing shall be performed at the expense of the contractor installing the material being tested:

A. Material Substitution: Any tests of basic material or fabrication equipment offered as a substitute for specified item on which a test may be required in order to prove its compliance with the specifications.

B. Mechanical/Electrical: Tests on mechanical and electrical systems required to insure their proper installation and operation.

C. Any test that fails shall be paid for by the installing contractor subject to the following conditions:
   1. Quantity and nature of tests will be determined by the Consultant.
   2. All test shall be done in the presence of the Owner or his representative.
   3. Proof of noncompliance will make the installing contractor liable for any corrective action which the Owner feels is prudent including complete removal and replacement of defective material.

Nothing contained herein is intended to imply that the installing contractor does not have the right to have tests performed on any material at any time for his own information and job control so long as the Consultant or Owner does not assume responsibility for costs or for giving them consideration when appraising quality of materials.

D. The Consultant shall determine the type and number of tests to be performed on the project.

1.02 TEST REPORTS

Reports of all tests made by testing laboratories shall be distributed by the testing laboratory as follows:
1 copy - Contractor
1 copy - Applicable supplier or subcontractor
1 copy - Owner
1 copy - Consultant
Other copies - as directed

1.03 QUALITY CONTROL SYSTEM

A. General: The contractor shall establish a quality control system to perform sufficient inspection and tests of all items of work, including that of all subcontractors, to ensure conformance to the Contract Documents for materials, workmanship, construction, finish, functional performance and identification. This control shall be established for all construction except where the Contract Documents provide for specific compliance tests by testing laboratories or Consultants employed by the Owner.

The quality control system is the means by which the Contractor assures that construction complies with the requirements of the Contract Documents. Controls shall be adequate to cover all construction operations and should be keyed to the proposed construction schedule.
B. The Contractor shall designate a quality control representative on staff to review the work to insure compliance with the contract documents by weekly jobsite visits for observation. The designated employee shall not be involved in the performance of the work. The quality control representative shall review the work and make necessary corrections to bring the work into compliance prior to scheduling the Architect for the final punchlist review.

C. Records: The Contractor shall maintain correct records on an appropriate form for all inspections and tests performed, instruction received from the Owner and actions taken as a result of those instructions. These records shall include evidence that the required inspections or tests have been performed (including type and number of inspections or tests, nature of defects, causes for rejection, etc.) proposed or directed remedial action, and corrective action taken. The Contractor shall document inspections and tests as required by each Section of the Specifications.

1.04 INDEPENDENT TESTING AGENCY SERVICES

A. The Owner will employ and pay for the services of an independent Testing Agency to perform the Inspections, special inspections, tests and other services when required by sections of the specification. Services shall be performed in accordance with requirements of governing authorities and with specified standards.

1. Contractor shall cooperate with Testing Agency personnel and shall furnish tools, sample of materials, design mixes, equipment and assistance as requested.

2. Contractor shall provide and maintain, for the sole use of the Testing Agency, adequate facilities for the safe storage and proper curing of concrete testing cylinders on the project site for the first 24 hours after casting as required by ASTM C 31, Method of Making and Curing Concrete Test Specimens in the field.

3. Contractor shall notify Testing Agency sufficiently in advance of operations to allow for completion of initial tests and proper assignment of inspection personnel.

4. Contractor shall notify the testing agency sufficiently in advance of cancellation of required testing operations. The Contractor shall assume responsibility for costs incurred due to the failure to provide such notice.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS
   A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF REQUIREMENTS
   A. This section of the General Requirements outlines the basic requirements for temporary services, utilities, and facilities which will indirectly enable adequate construction progress and processes, and will accommodate other necessary activities at the project site except as otherwise indicated, the costs of providing and using temporary services are included in the Contract Sum.

1.03 QUALITY ASSURANCE
   A. Comply with governing regulations and utility company regulations and recommendations for the construction of temporary facilities, including but not necessarily limited to, code compliance, permits, inspections, testing, and health and safety compliance.

1.04 SITE CONDITIONS
   A. Provide Temporary facilities and services at the time first needed at the site and maintain, expand, and modify the facilities as needed throughout the construction period and do not remove until no longer needed.

PART 2 - EXECUTION

2.01 GENERAL
   A. Use qualified tradesmen for the installation of temporary facilities. Locate facilities where they will serve the total project construction work adequately and result in minimum interference with performance of the work. Relocate, modify, and extend facilities as required during the course of the work to properly accommodate the entire work of the project.

2.02 TEMPORARY FACILITIES
   A. Temporary Water: Connect to existing water source as designated by the Owner for construction operations.

   B. Temporary Telephone: Provide, maintain and pay for telephone service to field office at time of project mobilization. If a mobile phone is designated as the field office phone then it shall be a local number.

   C. Sanitary Facilities: Comply with governing regulations, including safety and health codes for the type, number, location, operation, and maintenance of fixtures and facilities. Install sanitary facilities in available locations which will best serve the needs of personnel at the project site. Toilet rooms in existing buildings or in new construction may not be used without written approval of the Owner.
D. Temporary Heat and Ventilation: Provide such OSHA approved heat and fuel, heating units, equipment as necessary to provide the required environmental conditions and to protect the work from damage due to cold. Maintain equipment in a clean, safe condition.

E. Fire Extinguisher:
   1. Except as otherwise indicated or required, comply with the applicable recommendations of NFPA No. 10 "Portable Fire Extinguisher" for each area of each construction activity whenever combustible materials, flammable liquids, and similar exposures to possible fires are present.
   2. Locate extinguisher where most convenient and effective for the intended purposes. Store combustible materials in recognized fire-safe locations and containers.

F. Protection
   1. Barricades, Warning Signs, and lights: Comply with recognized standards and code requirements for the erection of substantial and structurally adequate barricades wherever needed to prevent accidents and losses. Paint with appropriate colors, graphics and warning signs to inform personnel at the site and the general public where exposure exists of the hazard being protected. Provide lighting where appropriate and needed for the recognition of the facility, including flashing red lights where appropriate.

G. Temporary Enclosure: Wherever required, provide temporary enclosure of materials, equipment, work in progress, and completed portions of work, so as to afford protection for both the work and employees.

H. Miscellaneous Facilities:
   1. Provide ladders, ramps, and temporary stairs for access to all levels of the construction for general access by all trades. Individual contractors and subcontractors shall furnish their own stepladders, scaffolds, staging, work platforms, and other facilities for use of their workmen and as necessary for safety of all personnel.

I. Field Office:
   1. The Contractor shall provide and maintain a suitable temporary field office for his own use. Offices and all other temporary structures shall be removed from the site upon completion of the work.
   2. Temporary structures or storage used for storage and offices for contractors shall be located on the site in an orderly manner as determined by the Owner.

2.03 OPERATIONS AND TERMINATIONS

A. Supervision: Enforce strict discipline in the use of temporary facilities at the project site. Limit availability of facilities to essential and intended uses, so as to minimize waste and possibility of abuses and the resulting unsanitary and hazardous or dangerous conditions.
B. Maintenance: Operate and maintain temporary facilities in good operating condition through the
time of use and until removal is authorized. Protect from damage by freezing temperatures and
similar elements at the site.

C. Termination and removal: At the time the need has ended for each temporary facility, or when it
has been replaced by authorized use of a permanent facility, or at the time of Substantial
completion, promptly remove the facility unless requested by the Consultant to be retained for a
longer period of time. Complete or restore permanent work which may have been delayed or
otherwise affected by the temporary facility. Replace work which cannot be satisfactorily
restored. Except as otherwise indicated, the materials and equipment of temporary facilities
remain the property of the contractors.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Products.
   2. Transportation and Handling.
   4. Manufacturer's Instructions.
   5. Product Options.
   6. Products List.
   7. Substitutions.

B. Related Sections:
   1. Section 01400 - Quality Control.
   2. Section 01730 - Operation and Maintenance Data.

1.02 QUALITY ASSURANCE

A. Conform to applicable specifications and standards.

B. Comply with size, make, type and quality specified, or as specifically approved in writing by the Consultant.

C. Manufactured and Fabricated Products:
   1. Two or more items of the same kind shall be identical, by the same manufacturer.
   2. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.

1.03 TRANSPORTATION AND HANDLING

A. Arrange deliveries of products in accord with construction schedules, coordinate to avoid conflict with work and conditions at the site.

B. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.

1.04 STORAGE AND PROTECTION

A. Store products in accordance with manufacturer’ instruction, with seals and labels intact and legible.

B. Arrange storage to provide access for inspection. Periodically inspect to assure products are undamaged, and are maintained under required conditions.

1.05 MANUFACTURER'S INSTRUCTIONS

A. When Contract Documents require that installation of work shall comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to parties involved in the installation, including one copy to the Consultant and one copy to the Contractor.
B. Perform work in accord with manufacturer's instructions. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by Contract Documents.

1.06 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards.

B. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not specifically named.

C. Consultant will review requests for substitutions with reasonable promptness, and notify, by Addendum, of the decision to accept or reject the requested substitution.

1.07 PRODUCT LIST

A. Within 15 days after signing of agreement, submit complete list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

1.08 SUBSTITUTIONS

A. Will only be considered prior to bid or in the event that Equipment is not available.

1.09 SYSTEMS DEMONSTRATION

A. Prior to final inspection, demonstrate operation of each system to Consultant and Owner.

B. Instruct Owner's personnel in operation, adjustment, and maintenance of equipment and systems, using the operation and maintenance data as the basis of instruction.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION
PART 1 - GENERAL

1.01 SUBSTANTIAL COMPLETION AND FINAL INSPECTION

A. The Contractor shall comply with procedures stated in the General Conditions of the Contract for Notice of Completion, Final Inspection, Notice of Substantial Completion and Notice of Acceptance.

B. Should the Architect/Engineer or the Principle Representative determine that the work is not substantially complete, or the punch list items exceed 25, he will immediately notify the Contractor, in writing, stating reasons. After Contractor completes work, he shall resubmit certification and request for final inspection. The Contractor will be responsible for all costs beyond two Architect/Engineer walk-throughs.

C. Owner may occupy designated portions of the Project under provisions stated in the General Conditions of the Contract.

1.02 CLOSE-OUT FORMS

The Architect/Engineer will complete the Notice of Approval of Beneficial Occupancy, Closing-out Checklist and Contract Close-out forms and forward them to the Contractor. Comply with procedures stated in General Conditions of the Contract.

1.03 FINAL SETTLEMENT AND PAYMENT

A. Contractor shall comply with procedures stated in the General Conditions of the Contract before final settlement and payment are made.

B. The Contractor shall also submit the following prior to the final application for payment:
   1. Contractor’s Affidavit of Payment of Debit and Claims: AIA G706.
   2. Contractor’s Affidavit of Release of Liens (claims): AIA G706A, with:
      a. Consent of Surety to final payment: AIA G707
      b. Contractor’s release of waivers of claims.
      c. Separate release of waivers of claims for subcontractors, suppliers and others with claim rights, against property of owner, together with list of those parties.

1.04 GUARANTEE INSPECTION

A. The Contractor shall comply with procedures stated in the General Conditions of the Contract for Guarantee Inspections after completion of the work.

1.05 WARRANTIES AND SPECIAL GUARANTEES

The Contractor shall comply with procedures and criteria outlined in the General Conditions of the Contract for all warranties and special guarantees of the work.

1.06 OPERATING AND MAINTENANCE DATA

A. Refer to Section 01730 - Operating and Maintenance.

B. Mechanical - By Mechanical Contractor: See Division 15.
C. Electrical - By Electrical Contractor: See Division 16.

1.07 DEMONSTRATIONS

A. Refer to Section 01730 - Operating and Maintenance

B. Mechanical - By Mechanical Contractor: See Division 15

C. Electrical - By Electrical Contractor: See Division 16.

1.08 SPARE PARTS AND MAINTENANCE MATERIALS

A. Provide products, spare parts, and maintenance materials in quantities specified in each Section, in addition to that used for construction of work. Coordinate with Owner, deliver to Project site and obtain receipt prior to final payment.

B. At the completion of the project, all loose keys for hose bibs; adjustment keys and wrenches for door closers and panic hardware; and keys for electric switches, electrical panels, etc., shall be accounted for by the Contractor and turned over to the Owner.

END OF SECTION
PART 1 - GENERAL

1.01 CLEANING

A. Clean-up During Construction: Each contractor shall keep the building and premises free from all surplus material, waste material, dirt and rubbish caused by his employees or work, and at the completion of his work he shall remove all such surplus material, waste material, dirt and rubbish, as well as his tools, equipment and scaffolding, and shall leave his work clean and spotless, unless more exact requirements are specified. In case of dispute, the owner may remove all such items and charge the cost of such removal to the contractor.

Each sub-contractor shall perform his clean-up daily and shall transport his rubbish to an on-site location designated by the Contractor who will arrange for its removal.

B. Cleaners: With the exception of clean-up of the site and cleaning specifically assigned to Contractors under various sections of the specifications, all final clean-up of exterior and interior of the building shall be done by professional cleaners.

C. Final Clean-up:
   1. Exterior: In addition to items specified below, any new surfaces on exterior, concrete, metal, etc., shall be carefully and thoroughly cleaned.
   2. Glass: Both sides of all glass in work areas shall be carefully and thoroughly cleaned by professional window cleaners and left absolutely clean and free from paint, grease, dirt, etc.
   3. Hardware: Clean and polish all hardware and leave clean and free from paint, grease, dirt, etc.
   4. Plumbing: Clean and polish all plumbing fixtures, fittings, and exposed plated piping. Leave clean and free from paint, grease, dirt, etc. Remove all labels.
   5. Electrical: Clean and polish all electric fixtures, including glassware, switch plates, etc. and leave clean and free from paint, grease, dirt, etc.
   6. Equipment: Carefully and thoroughly clean all items of equipment, mechanical, electrical, cabinets, ductwork, etc.
   7. Floors: Thoroughly clean all floors. Vacuum and clean carpeting. Shampooing of pre-existing carpet is required once project is complete. Contractor is responsible for this.
      a. Contractors are responsible for cleaning (stripping floors if necessary) then applying the required two coats of sealer and three coats of finish before releasing the building for occupancy. Facilities Management will provide a contact person for help concerning campus standards free of charge. Or Custodial floor care services may be sub-contracted out through Facilities Management’s work order system.
      b. Facilities Management Approved Sealers and Finishes for Vinyl Tile Flooring:

CU requires floor care products to be from the same product line. (Different brands may interact disastrously).

All of these products may be ordered through Construction Stores, but these products not stocked at Stores, please place orders at least two weeks in advance.
Campus safety standards require at least TWO (2) coats of Sealer be applied to a cleaned floor, and at least THREE (3) coats of Finish must be applied on top of the sealer.

c. Floor Cleaning Procedures:
   1. Sweep floor clean of debris
   2. Cord off area if necessary
   3. Put up Caution signs
   4. Mix Stripper or Cleaning solution according to label
   5. Apply solution to floor
   6. Start setting up equipment
   7. Place RED abrasive pad on buffer (buffer less than 300 rpms)
   8. Begin stripping or cleaning floor working with buffer moving it side to side across the floor.
   9. Use HEPA filtered water vacuum to begin to suck up slurry*
      *use of HEPA filtered water vacuum is required on existing floor tile which contains asbestos.
   10. Apply additional coats of water and re-vacuum up floor
   11. Mop floor with clean water, change rinse water often
   12. Mop floor a second time
   13. Mop floor to dry completely
   14. Clean up equipment
   15. Wash red pad with clean water.

d. Sealing Procedures:
   1. Using a new mop head or clean wax mop and clean bucket, apply first coat of approved sealer to floor
   2. Allow floor to dry completely (at least 20 minutes)
   3. Apply second coat of sealer
   4. Allow floor to dry

e. Finishing (Waxing) Procedures:
   1. Using a clean wax mop and bucket apply first coat of approved finish (wax)
   2. Allow floor to dry completely (at least 20 minutes)
   3. Apply second coat of finish (wax)
   4. Allow floor to dry completely (at least 20 minutes)
   5. Apply third coat of finish (wax)
   6. Allow floor to dry completely (at least 30 minutes)
   7. Wash mop and bucket with clean water
   8. If floor is dry - remove caution signs and open area up
f. **Burnishing Procedures:**
   The next working day
   1. Sweep floor clean of debris
   2. Spot mop floor to remove spots and dirt
   3. Set up High Speed Burnisher to make for a safe environment
   4. Start Burnishing. Walk forward in a straight line
   5. At end of row, turn around and start forward again
   6. Repeat steps 5 & 6 until finished
   7. Clean up equipment and pad.

E. **Completion:** The entire work inside and out, and the entire premises shall be in first-class, clean condition upon completion before being accepted by the Owner.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. This section describes the definitions, recording and maintenance requirements and the submittal requirements for record documents.

1.02 DEFINITIONS

A. The Project Record Documents are intended to indicate all changes and deviations from the original contract documents and permanently record the "as-built" condition of material, equipment and structure. The project record documents shall include the contract drawings, project manual, addenda, change orders, modifications and clarifications, field directives, approved shop drawings, approved product data, manufacturer’s certificates and project test results.

1.03 SUBMITTALS

A. Submit the project record documents in conformance with Section 01700 and prior to the final applications for payment. The final application for payment will not be approved prior to the submittal of record documents.

1.04 QUALITY ASSURANCE

A. The project record documents shall be updated at a minimum on a weekly basis and shall be readily available for inspection by the owner and consultants. Maintain a separate set of complete documents for exclusive use of record documents and protect the documents from damage in a clean, dry location. Note: Progress applications for payment will not be approved if record documents are not current.

B. The record documents shall contain a clear, legible record of all detail and dimensional changes and locate all concealed work including, but not limited to:
   1. Interior and Exterior Utilities
   2. Valves
   3. Dampers
   4. Controls
   5. Junction Boxes
   6. Clean-outs
   7. Access Doors

C. The project manual (specifications) shall indicate all manufacturers’ products complete with catalogue number and trade name of products installed. All changes and corrections to the project manual shall be clearly indicated.

END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Compile product data and related information appropriate for the University of Colorado's maintenance and operation of products furnished.

B. Prepare operating and maintenance data as specified in this section and as referenced in other pertinent sections of specifications.

C. Instruct the University of Colorado, Facilities Management personnel in the maintenance of PRODUCTS and in the operation of equipment and systems.

1.02 QUALITY ASSURANCE

A. Preparation of data shall be done by personnel:
   1. Trained and experienced in maintenance and operation of the described products.
   2. Completely familiar with requirements of this section.
   3. Skilled as a technical writer to the extent required to communicate essential data.
   4. Skilled as a draftsman competent to prepare required drawings.

1.03 SUBMITTALS

A. Prepare data in the form of an instructional manual for use by the University of Colorado, Facilities Management personnel. Quantities are listed in Part 1.07.

B. Format:
   1. Submit electronically in Portable Document Format (PDF) format as one document, OCR (Optical Character Recognition) searchable, bookmarked according to the Construction Specifications Institute (CSI) standards.

   2. Title shall be “OPERATING AND MAINTENANCE INSTRUCTIONS”, and shall include:
      a. Name of project and date of completion (month and year).
      b. Project number.
      c. Identify of general subject matter covered in the manual (e.g., Architectural, Mechanical, Electrical and/or Civil).

1.04 CONTENT OF MANUAL

A. An electronically-written table of contents shall be provided for each volume, arranged according to CSI standards.
   Include the following:
   1. Name of responsible installing principal contractor, address, and telephone number.
   2. A list of each product being included, indexed to the content of the volume.
   3. List with each product, the name, address, and telephone number of:
      a. Maintenance contractor, as appropriate.
      b. Identity of the area of responsibility of each.
   4. Identify each product by product name and other identifying symbols.
B. Product Data:
1. Local source of supply for parts and replacement.
2. Include only those sheets that are pertinent to the specific product, with the following information.
   a. Clearly identify the specific product or part installed.
   b. Clearly identify the data applicable to the installation.
   c. Delete references to inapplicable information.
C. Drawings:
1. Supplement product data with drawings as necessary to clearly illustrate:
   a. Relations of component parts of equipment and systems.
   b. Control and flow diagrams.
2. Coordinate drawings with information in project record drawings to ensure correct illustration of completed installation.
3. Do not use project record drawings as maintenance drawings.
D. Provide written text, as required, to supplement product data for the particular installation:
1. Organize in a consistent format under separate headings for different procedures.
2. Provide a logical sequence of instructions for each procedure.
E. Provide a copy of each warranty, bond, and service contract issued. Provide information sheets for the University of Colorado, Facilities Management's personnel and give:
1. Proper procedures in the event of failure.
2. Instances that might affect the validity of warranties or bonds.

1.05 MANUALS FOR ARCHITECTURAL MATERIAL AND FINISHES
A. Submit copies (per schedule shown in paragraph 1.07) of complete manual in final form.
B. Content for architectural products include applied materials and finishes.
1. Manufacturer's data, giving full information on products.
   a. Catalog number, size, and composition.
   b. Color and texture designations.
   c. Information required for reordering special manufactured products.
2. Instructions for care and maintenance:
   a. Manufacturer's recommendation for types of cleaning agents and methods.
   b. Cautions against cleaning agents and methods that are detrimental to the product.
   c. Recommended schedule for cleaning and maintenance.
C. Content for moisture-protection and weather-exposed products:
1. Provide manufacturer’s data, giving fully information on products.
   a. Applicable standards
   b. Chemical composition
   c. Details of installation
2. Provide instructions for inspection, maintenance, and repair.
1.06 MANUAL FOR NON-ARCHITECTURAL EQUIPMENT AND SYSTEMS

A. Submit copies (per schedule) of complete manual in final form.

B. Content for each unit of equipment and system, as appropriate shall contain:
   1. Description of unit and component parts (Consultant-approved submittals).
      a. Function, normal operating characteristics, and limiting conditions.
      b. Performance curves, engineering data, and tests.
      c. Complete nomenclature and Commercial number of all replaceable parts.
   2. Operating Procedures:
      a. Start-up, break-in, routine, and normal operating instructions.
      b. Regulation, control, stopping, shutdown, and emergency instructions.
      c. Summer and winter operating instructions.
      d. Special operating instructions.
   3. Maintenance Procedures:
      a. Routine operations.
      c. Disassembly, repair, and reassembly.
      d. Alignment, adjustment, and checking.
   4. Servicing and Lubrication Schedule, including a list of lubricants required.
   5. Manufacturer's operating and maintenance instructions.
   6. Description of sequence of operation by control manufacturer.
   7. Original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance and replacement.
      a. Predicted life of parts subject to wear.
      b. Items recommended to be stocked as spare parts.
   8. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

C. Content for each electric and electronic system, as appropriate, shall contain:
   1. Description of system and component parts:
      a. Function, normal operating characteristics, and limiting conditions.
      b. Performance curves, engineering data, and tests.
      c. Complete nomenclature and Commercial number of replaceable parts.
   2. Operating Procedures:
      a. Routing and normal operating instructions.
      b. Sequences required.
      c. Special operating instructions.
   3. Maintenance Procedures:
      a. Routing operations.
      c. Disassembly, repair, and reassembly.
      d. Adjustment and checking.
      e. Manufacturer's printed operating and maintenance instructions.
      f. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

D. Prepare and include additional data when the need for such data becomes apparent during instruction of the University of Colorado, Facilities Management's personnel.
1.07 OPERATION & MAINTENANCE MANUAL

A. Operations and Maintenance Manuals – all disciplines – submit electronically in Portable Document Format (PDF) format as one document, OCR (Optical Character Recognition) searchable, bookmarked according to the Construction Specifications Institute (CSI) standards.

1.08 SUBMITTAL SCHEDULE

A. Submit one electronic copy to the Consultants and one to the University of draft of proposed formats and outlines of contents upon completion of the submittal process. The Consultants and the University staff will review the draft and will submit comments through the consultants.

B. Submit electronic copies of complete manual(s) in final form 15 days prior to final inspection or acceptance. Comments will be submitted after final inspection.

C. Submit specified number of CDs or DVDs of approved data in final form prior to acceptance.

1.09 INSTRUCTION OF UNIVERSITY OF COLORADO, FACILITIES MANAGEMENT PERSONNEL

A. Fully instruct the University of Colorado, Facilities Management personnel's designated operating and maintenance personnel in the operation, adjustment, and maintenance of all products, equipment, and systems as required elsewhere in the specification.

B. Operating and Maintenance manual may be required as the basis of instruction.

PART 2 - MATERIAL

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Prepare commissioning process based on the Commissioning Checklists found in the UCB Standards website:

http://fm.colorado.edu/construction/standards/

B. Coordinate the requirements of Project Closeout and Operating and maintenance sections that are part of Division 1.

C. Schedule the required commissioning activities with the University of Colorado Facilities Department and their consultants at least 72 hours prior to conducting Commissioning activities.

PART 2 - MATERIALS

Not Used.

PART 3 - EXECUTION

NOT USED

END OF SECTION
PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:
   1. Construction Storm Water Requirements
   2. Post-Construction Storm Water Requirements

B. Related Sections
   1. Section 02200 - Earthwork
   2. Section 02221 – Trenching, Backfilling, Compaction

1.02 QUALITY ASSURANCE

A. All construction sites
   1. All construction sites that disturb any land must take appropriate erosion control and
     stormwater detention measures to contain water run-off from site.

B. Construction sites – one acre and larger
   1. All construction sites that are one acre and larger must prepare and submit a Storm
     Water Management Plan (SWMP) for approval before any work begins. The SWMP
     must conform to all the requirements contained herein.

1.03 SUBMITTALS

A. Storm Water Management Plan (SWMP)

Storm Water Management Plan (SWMP): Prior to any construction activity disturbing one acre of
land or more, an approved SWMP and a Stormwater Permit for Construction Activity application
from the Colorado Department of Public Health and Environment (CDPHE) are required. The
SWMP shall be prepared in accordance with the CDPHE requirements for “Contents of the
Stormwater Management Plan” and the UDFCD’s Urban Storm Drainage Criteria Manual,
management and erosion control measures are to be constructed and maintained in accordance
with the SWMP and the UDFCD Drainage Criteria Manual.

PART 2 – MATERIALS

2.01 Storm Water Management Plan

A. Preparation Standards: Design of the SWMP and the Storm Water Quality and Erosion Control
   Plan shall include the following elements:
   1. Protection for adjacent properties (including public right-of-way) from erosion and/or
      sediment deposition.
   2. Protection for public streets from the deposit of sediment from run-off or vehicles tracking
      mud at construction access routes.
   3. Stabilization for all disturbed areas as defined in the UDFCD Drainage Criteria Manual.
4. Protection for all storm sewer inlets from the entry of sediment-laden water.
5. Long-term stability of cut and fill slopes and the successful establishment of permanent vegetative cover on exposed soil.
6. The following standard notes:
   a. “All temporary erosion control facilities shall be installed before any construction activities take place”.
   b. “Solid waste, industrial waste, yard waste and any other pollutants or waste on any construction site shall be controlled through the use of BMP’s. Waste and/or recycling containers shall be provided and maintained by the owner or contractor on construction sites where there is the potential for release of waste. Uncontained waste that may blow, wash or otherwise be released from the site is prohibited. Sanitary waste facilities shall be provided and maintained by the owner or contractor”.
   c. “Ready-mixed concrete, or any materials resulting from the cleaning of vehicles or equipment containing or used in transporting or applying it, shall be contained on construction sites for proper disposal. Release of these materials is prohibited”.
   d. “Cover shall be applied within 14 days to inactive soil stockpiles, and shall be maintained for stockpiles that are proposed to remain in place longer than 30 calendar days”.
   e. “BMP’s shall be implemented to prevent the release of sediment from construction sites. Vehicle tracking of mud shall not be allowed to enter the MS4 or waters of the State. Sediment tracked onto public streets shall be removed immediately”.
   f. “Techniques shall be used to prevent dust, sediment or debris blowing from the site”.
   g. “Stormwater discharges from construction activities shall not cause or threaten to cause pollution, contamination or degradation of waters of the State”.
   h. “All earth disturbances shall be designed, constructed and completed to limit the exposed area of any disturbed land to the shortest possible period of time”.
   i. “Bulk storage structures for petroleum products and other chemicals shall have adequate protection so as to contain all spills and prevent any spilled material from entering the MS4 or waters of the State”.
   j. Any disturbance to temporary and permanent BMP’s resulting from construction activity shall be repaired or replaced within 48 hours.

PART 3 – EXECUTION

3.1 PERMITTING

   A. Contractor shall develop the SWMP in accordance with all of the requirements herein and utilizing the most recent SWMP guidance document prepared by the CDPHE and good engineering hydrologic and pollution control practices and submit to the University for approval.

   B. Contractor shall apply for and obtain a CDPHE storm water general permit for construction activities. Provide copies of the permit to the University prior to the start of construction operations.
3.2 CONSTRUCTION

A. The Contractor will be required to have the SWMP on site at all times and shall be prepared to respond to maintenance of specific BMP’s.

B. The Contractor shall inspect all BMP’s at least every 14 days and within 24 hours after any precipitation or snow melt event that causes surface run-off. Inspections of BMP’s shall be conducted by an individual who has successfully completed formal training in erosion and sediment control by an organization acceptable to the University. A certification of successful completion of such training shall be provided upon request.

C. The Contractor shall amend the SWMP whenever there is a change in design, construction, operation, or maintenance, which has an effect on the potential for discharge of pollutants to the MS4 or receiving waters, or if the SWMP proves to be ineffective in achieving the general objectives of controlling pollutants in stormwater discharges associated with construction activities.

D. Records of inspection are to be maintained on site with the SWMP. Inspection records are to be available at the project site at all times and shall be made available to the University upon request.

E. Prior to commencement of work, all general contractors, subcontractors and utility agencies shall obtain and comply with the approved, current SWMP for the project.

3.3 POST CONSTRUCTION

At the conclusion of all construction activities and as a part of construction close-out, contractor shall remove all temporary BMP’s and inactivate the stormwater permit.
SECTION 02111
TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes:

1. Installation of Fencing.
2. Installation of Boxing.
3. Siltation Control.
4. Transplanting.
5. Tree Removals.
6. Protection of Trees to Remain

B. Related Work:

1. Section 01010 ‘Contractor’s Access and Staging Areas’
2. Section 01500 ‘Temporary Facilities’
3. Section 02110 ‘Site Clearing’
4. Section 02200 ‘Earthwork’
5. Section 02221 ‘Trenching, Backfilling, Compacting’
6. Section 02920 ‘Soil Preparation’
7. Section 02930 ‘Bluegrass Seeding’
8. Section 02931 ‘Native Grasses Seeding’
9. Section 02932 ‘Bluegrass Sodding’
10. Section 02950 ‘Trees, Plants and Groundcovers’

1.2 REFERENCES

A. ANSI Z133.1 Safety Requirements for Pruning, Trimming, Repairing, Maintaining and Removing Trees, and for Cutting Brush.


1.3 DEFINITIONS
A. Tree Protection Fencing: Temporary fencing installed prior to site preparation and demolition which protects a group of trees or shrubs.

B. Boxing: Temporary wood box form installed prior to site preparation and demolition which protects individual trees and shrubs.

C. Root Pruning: Physical cutting of plant roots to minimize root damage and promote healing.

D. Construction Branch Pruning: Physical cutting of any branch which interferes with construction.

1.4 SUBMITTALS

A. Comply with Section 01300. All submittals shall be accepted by the Landscape Architect in writing before Work commences.

B. Schedule: Submit construction schedule which includes time frame for work near existing plant material. Provide transplanting and tree removal schedule including tree transplants and locations. Obtain approval by Landscape Architect prior to beginning of transplanting work and construction near restricted area.

C. Work Methods: Submit proposed methods and schedule for effecting tree and plant protection for approval, including proposed methods, materials, and schedule for root pruning, construction pruning, aeration and subsequent tree fertilization. Mark plan location of root pruning and siltation fencing in field with paint for approval by Landscape Architect. Any root pruning which is required due to construction work adjacent to existing trees and shrubs designated to remain shall occur any time ground can be worked except when tree or shrubs are in leaf. Root pruning when tree or shrubs are in leaf may occur only with approval by Landscape Architect.

1.5 QUALITY ASSURANCE

A. Comply with Division One.

B. Qualifications

1. Arborist: Company having adequate capacity and facilities to meet the specified requirements. All tree pruning and cleaning shall be performed by a landscape contractor with a minimum 5 years documented experience. Evidence to this effect shall be provided by the supplier if required by the Architect.

C. Regulatory Requirements: City permits are necessary for pruning or removal of all trees in the right-of-way.

E. Pre-Installation Conference
1. Conduct pre-installation conference prior to construction.
2. Attendance required by: Owner, Architect, Contractor(s), Manufacturer(s)/Supplier(s), other parties who are involved.

1.6 PROJECT/SITE CONDITIONS

A. All plant materials to remain or be moved will be tagged by the Landscape Architect to assist the Contractor in identifying the trees. Contractor to notify Landscape Architect seven (7) days before tree relocation. All relocated plant material to be included in maintenance – see 1.7.

B. Maintain all plant materials within tree protection areas. Designated tree protection areas of trees, shrubs, and grasses are to remain untouched and unharmed.

C. Construction activities, including stockpiling, in tree protection areas are prohibited.

D. Tree arborist shall determine and document value of each tree or other plant materials within the limits of work line that is designated to remain. Contractor shall reimburse client for the value of any of these trees or other plant materials that are lost or damaged during construction.

1.7 MAINTENANCE

A. Maintenance Services: Performed by a landscape contractor during construction and for the first year after final completion of all site construction.

B. Maintenance Period: Begin maintenance immediately upon start of construction. Continue maintenance until one year after final completion of all site construction.

C. Maintenance to Include:

1. Quarterly review and monitoring of tree conditions.
2. Maintaining guying and lightening protection. Repair or replace when required.
3. Water at a sufficient frequency to saturate root system and keep soil moist.
4. Pruning, including removal of dead or broken branches, and treatment of pruned areas or other wounds.
5. Disease Control.

D. Protection: In accordance with paragraph 3.2 Preparation-B.

E. Root Zone Fertilization: Root zone fertilize all trees affected by construction. The first root zone fertilization shall occur within 6 months after completion of site construction and the second within 12 months. Use a liquid application with an 18 inch soil probe. Fertilization mix shall be submitted to the Landscape Architect for acceptance prior to application.
F. Pesticides: Apply pesticides, with permission of owner, in accordance with manufacturer’s instructions. Remedy damage resulting from improper use of pesticides.

G. Maintenance Reports: Provide maintenance report including date and detailed summary of work completed on site, to the Landscape Architect after each maintenance visit.

PART 2 - PRODUCTS

2.1 TREE PROTECTION FENCING

A. Fencing: Galvanized chain link fencing, 6 ft. high.
   1. Tree protection fencing is the property of the Contractor.
   2. Gates at tree protection areas shall be 6'-0" width min. for maintenance vehicles and be 6'-0" ht. galvanized chain link fence.

B. Metal Fence Posts: 9 ft. galvanized steel posts, driven a minimum of 3 ft. into the ground. Space 10 ft. o.c.maximum.

2.2 SILTATION CONTROL FENCING

A. Fencing: 30" height. Siltation fencing complying to local codes.

B. Posts: Attach to tree protection fencing.

2.3 SOIL AMENDMENTS/MULCH


PART 3 - EXECUTION

3.1 NEW CONSTRUCTION

A. Curb cuts should not be closer than the dripline of the tree without permission from the Landscape Architect.

B. New sidewalks, paving or asphalt within the drip line of the tree must allow breathing space for tree roots. The following should be used as a guideline: For trees up to 4 inches in trunk caliper, 25 square feet of porous area is needed. For each additional 2 inches of tree caliper, 10 more square feet are needed.
C. Where grade change is required, the same area must be provided either by construction of a drywell where the level is to be raised or by building a retaining wall where the level is to be lowered. The grade within the drip line of the tree is not to be changed without Landscape Architect approval.

D. Avoid cutting surface roots wherever possible. Sidewalks and paving levels would be contoured sufficiently to avoid such cutting.

3.2 EXAMINATION

A. Verification Of Conditions: Examine areas and conditions under which the Work of this Section will be performed. Report unsatisfactory or questionable conditions to the Landscape Architect. Do not proceed with the Work until unsatisfactory conditions have been corrected. Commencement of work implies acceptance of all areas and conditions.

B. Verify all utility locations in the field prior to digging.

3.3 PREPARATION

A. Marking of Construction/Demolition/Tree Preservation Limits

1. Clearly mark the tree protection fence locations as indicated on the Drawings, boxing and all construction/demolition limits in the field.
2. Mark individual tree root pruning areas and location of siltation fencing with paint.
3. Verify all trees to be removed, transplanted, or protected with Landscape Architect. Tag all plant material with appropriate tags noting action to be taken with each plant.
4. Contact and accompany Landscape Architect on a joint review of construction/demolition limits, tagging and painting before prior to the installation of the tree protection fencing and start work.
5. Verify with Landscape Architect all trees to remain along the relocated irrigation ditch.
6. Limit of construction is generally defined as the limit of demolition. Contractor to immediately notify Architect if work will occur outside the construction/demolition limits.
7. Contractor to verify limits of existing R.O.W. Contractor to obtain all necessary permits from appropriate jurisdictions prior to commencing activity within the R.O.W.

3.4 INSTALLATION OF FENCING

A. Fencing: Install tree protection fencing prior to start of demolition work and clearing and grubbing operations in accordance with the following:
1. Following approval of staking by the Landscape Architect, install fencing at the tree protection areas.
2. Install fencing as approved. No fencing is allowed within three (3) feet outside the drip line of trees.
3. Install posts 10'-0" o.c. maximum.
4. Install gates where noted on the plans.

3.5 SILTATION CONTROL

A. Fencing: Provide silt control at Tree Protection Areas by attaching silt fence to the uphill side of the protective fencing. Place lower 6" of silt fence in trench below grade. Backfill trench.

B. Drainage: Maintain positive drainage from Tree Protection Areas. Divert runoff from site around Tree Protection Areas.

3.6 TREE REMOVALS

A. Schedule: Obtain approval of schedule prior to starting work.

B. Notification: Trees to be removed according to the Tree Protection Plans shall be tagged by the Contractor and approved by the Architect prior to removal.

C. Stump Removal: Remove tree stumps by Landscape Architect approved means to a depth of 12" below the proposed finished grade surface in lawn areas and 36" below finish grade in paved areas as determined by the Engineer. Remove wood chips from site. Fill stump removal areas with existing soil. Chemicals which will harm future landscape above stumps may not be applied to aid in stump removal.

D. Disposal: Dispose of all removals from the site at an approved disposal or recycling facility. Contractor may grind tree removals to be used for mulching purposes if mulch is approved by the Landscape Architect. Removals or mulch become the property of the Contractor.

E. Protection: Contractor responsible for protection of all trees designated to remain or transplanted during removal procedures.

3.7 ROOT PRUNING AND PROTECTION

A. Root Pruning

1. Prune roots where construction will sever roots.
2. Only clean cutting methods are acceptable. Root pruning is the physical cutting of tree roots to minimize root damage and promote healing. Unsuitable means for root
pruning include trenching, vibrating plow, stump grinder. Any method which tears roots or disturbs the soil beyond the grading limit is unacceptable.

3. Hand trim roots at trench walls. Make clean cuts through roots.
4. Prune tree roots to a depth no greater than required by construction excavation, by approved means only. All roots shall be pruned by an approved method.

B. Backfill: Close trenches within 24 hours. Backfill root pruning trench with existing soil. Tamp lightly to set soil.

1. When trench closing is not possible within 24 hours, protect trench side in accordance with this Section.

C. Mulching: Apply wood mulch to a depth of 4 in. to 5 in. at minimum 10 ft. to 15 ft. radius around tree to reduce compaction and increase moisture retention. Soil shall be kept moist in root pruning areas.

D. Root Protection: If tree roots larger than two (2) inches in diameter are encountered with digging or trenching, tunnel under for any improvements if possible. Dig trench by hand only.

2. Notify Landscape Architect to allow physical inspection of excavation around root zones to determine damage and health of tree. Do not tear the roots out. Removal of two (2) inches or larger diameter roots encountered during construction is not allowed without permission of Landscape Architect.
3. Upon approval by Architect, wrap cut roots 2’ and larger with burlap to prevent scarring or excessive drying.

3.8 CONSTRUCTION BRANCH PRUNING

A. Prune any branches of trees to be preserved which interfere with construction only at the direction of the Landscape Architect. Approval of all proposed pruning is required prior to start of work. Pruning is an incidental pay item associated with the transplanting of existing trees, the planting of new trees, and the care of existing trees to remain. Payments for such incidental items shall be drawn from the project budget.

B. Remove any branches which are weak or dead.

C. Any pruning included as part of the project shall be done by a licensed tree company and in accordance with good pruning practices as approved by the Landscape Architect. Pruning shall maintain balance, form and function of tree.

3.9 TEMPORARY TREE GUYING
A. Upon review of on-site root pruning and construction grading limits, the Landscape Architect shall determine whether the existing trees designated to remain should be temporarily guyed.

B. Complete tree guying using materials and techniques designated by the Landscape Architect in accordance with Section 02900 and complete in a timely manner.

3.10 AERATION

A. If areas inside the restricted area become compacted as determined by the Landscape Architect, aerate to a 20 inch depth using an aeration "grow gun," avoiding damage to surface absorbing feeder roots.

B. Inject filler material to hold aeration fractures open.

3.11 WATERING

A. Apply supplemental watering to a depth of 10-12" (18" max) with a deep root feeder if loss of grasses or heating of the roots occurs during construction or as directed by Landscape Architect. Approximately 100 gallons per tree shall be applied.

B. Contractor to water existing trees as determined by Landscape Architect to promote healthy, thriving plant material.

C. Contractor and Landscape Architect to determine appropriate water pressure.

3.12 EXCAVATION INSULATION

A. Provide mitigation from moisture and temperature fluctuations by pinning 3 layers of burlap onto the entire face of excavations exposed for more than 24 hours.

B. Wet burlap insulation immediately following installation.

C. Keep moist for the entire period the excavation remains open.

D. Remove insulation prior to backfilling.

3.13 CHEMICALS, FERTILIZATION AND INSECT SPRAYING

A. No chemicals shall be applied or used around or near existing trees.

B. No fertilizers, insect sprays or other chemicals shall be applied before or during root or branch pruning process.
3.14 CONCRETE WASHOUT

A. Provide concrete washout in areas which drain away from the Tree Protection Areas as indicated on the Drawings. The Landscape Architect shall approve concrete washout area prior to the start of any site work.

3.15 GRADING AT TREE PROTECTION AREAS

A. All grading within protected areas shall proceed only after review and approval by the Landscape Architect.

B. All fill within protected areas must be approved by the Landscape Architect. Tamping of fill earth shall be allowed; compaction of fill earth shall not be allowed. No "cutting" of grades in root area shall be allowed.

3.16 FIELD QUALITY CONTROL/DAMAGE PENALTIES

A. Trees labeled as requiring "General Protection" or "Special Protection" adjacent to construction areas and in other key locations are identified on the Drawings. Loss of any of these trees due to Contractor neglect or improper construction activities will result in liquidated damages for the assessed value of the tree as determined by a licensed arborist. Damage to a portion of these trees will be assessed by the arborist and a portion of the liquidated damages will be assessed to the Contractor. A list of tree values for the project will be on file in the Landscape Architect's office. Any damaged tree not on this list shall be evaluated by the Architect as necessary to comply with this penalty.

B. A fine of $1,000 will be levied against the Contractor for each incident of construction (including construction traffic) inside tree protection areas.

C. Trees or roots visibly damaged will cause the Owner to withhold from the Contractor an assessed amount conforming to the requirements stipulated above, for a period of two years. After that period the impact of the damage to any tree will be assessed by the Landscape Architect.

D. If any trees or shrubs designated to be saved are damaged and replacement is required, a number and diameter of trees or shrubs of the same species and variety, as specified by the Landscape Architect, shall be furnished and planted by the Contractor. The total inch diameter of the replacement trees or shrubs shall equal the diameter of the tree or shrub to be replaced as measured by The Guide For Establishing Value of Trees and Other Plants, published by the International Society of Arboriculture. The Contractor shall not be liable for any loss or damage which occurs while the Contractor is complying with instructions given by the Landscape Architect working on the Project.
3.17 ADJUSTING

A. Tree Protection Area Access: When construction traffic is unavoidable as concurred by the Contractor and Landscape Architect the following procedure shall be followed:

1. Obtain approval from the Landscape Architect for Tree Protection Area access.
2. Install protective fencing by hand to delineate the construction corridor. Fencing location must be approved on site by the Landscape Architect.
3. Install a 12" layer of wood chips overlaid with continuous 3/4" plywood sheets on the existing grade for the entire area of the traffic route to allay rutting and slightly reduce soil compaction.
4. Remove all materials and return area to preconstruction condition within one week of the work.

B. Excavation Insulation: If in the Contractor's opinion, climate conditions do not necessitate the installation of burlap insulation at an excavation, he may submit to the Landscape Architect a written request to omit the burlap insulation. Submit request to the Landscape Architect 24 hours prior to excavation.

3.18 CLEANING

A. Removal Of Protection: Except as otherwise indicated or requested by Engineer, temporary protection devices and facilities installed during course of the work shall be removed only after all work which may injure or damage trees and plants is completed.

B. Removal: Remove all excess material during construction period and haul off-site.

C. Repair: Repair surface damage caused by fence posts. Restore to match surrounding conditions.

3.19 PROTECTION

A. Protect planting areas and plants at all times against damage of any kind for the duration of the maintenance. If any plants become damaged or injured, they shall be treated or replaced as directed by the Landscape Architect at no additional cost to the Owner. The contractor shall not be responsible for acts of vandalism or acts of God during the maintenance period.

B. Protect tree roots in accordance with paragraph 3.7 this Section.

C. Branch Protection: Contact Landscape Architect if it appears that construction will damage to the branches of any tree. The Landscape Architect will determine action to be taken. If pruning is required, perform in accordance with paragraph 3.8 this Section.

END OF SECTION 02111
SECTION 02200
EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY:

A. Section Includes:
   1. Soil Testing and Field Quality Control.

B. Related Sections:
   1. Section 01400 - Quality Control.
   2. Section 02010 - Subsurface Exploration: For Contractor's information and reference.
   3. Section 02110 - Site Clearing
   4. Section 02111 – Tree and Plant Protection
   5. Section 02221 - Trenching, Backfilling, Compacting: Pipe bedding and coverage materials including placement procedures.

1.2 INTENT:

1.3 CODES AND STANDARDS:

A. The most recent City of Boulder Design & Construction Standards are incorporated by reference into the University Standards. When there is a conflict between standards, the more stringent requirement shall apply. The University’s Civil must approve in writing any deviation from these standards prior to construction.

1.4 QUALITY ASSURANCE:

A. Perform all earthwork operations in conformance to the requirements herein specified. The Contractor may refer to the City of Boulder, Colorado Design and Construction Standards, most recent edition, for work not covered in this standard. The University of Colorado at Boulder Utilities Engineer shall approve the use of particular City of Boulder standards

B. Pre-Installation Conference: Prior to the start of the work of this section, conduct a pre-installation conference with Contractor, Owner, Architect, and Soils Engineer to discuss the following:
   1. Site preparation.
   2. Grading specifications.
   3. Equipment to be used.
   4. Unusual soil conditions.
   5. Special requirements.

C. Test Reports-Excavating, Filling and Grading:
   1. The following tests are generally performed by the Owner's testing laboratory. Copies of
test reports may be available to the Contractor. Coordinate with the Owner to determine which test information will be provided.

a. Field density reports for fills and backfills.
b. Testing reports on borrow material, including mechanical analysis, moisture-density curve and plasticity index.
c. Verification of each footing subgrade.
d. One optimum moisture-maximum density curve for each type of soil encountered.
e. Report of actual unconfined compressive strength and/or results of bearing tests of each strata tested.

1.3 SUBMITTALS:

A. Submit six copies of a report from a testing laboratory verifying that the material conforms to the gradation specified. This includes on-site materials that will be reused.

B. Dewatering plan including disposition of groundwater is required for University review. Also include a copy of any applicable and completed discharge permit, if required.

1.4 PROJECT/SITE CONDITIONS:

A. Site Information:

1. Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil borings.
2. It is expressly understood that Owner will not be responsible for interpretations or conclusions drawn by Contractor.
3. Data are made available for the convenience of the Contractor.
4. Additional test borings and other exploratory operations may be made by the Contractor at no cost to the Owner.

B. Use of Explosives: The use of explosives is not permitted.

C. Existing Utilities:

1. At least 48 hours prior to starting any work disturbing, moving or penetrating the ground, contact the Utility Notification Center of Colorado, 534-6700 or 1-800-922-1987, to locate, stake and identify depth of all buried utilities within the construction limits.
2. Locate existing underground utilities in the areas of work. Protect utilities to remain.
3. The existence and location of underground utilities and construction indicated as existing are not guaranteed. Excavate carefully so as not to damage uncharted utilities.
4. Should uncharted, or incorrectly charted, utilities be encountered, notify the Owner immediately for directions.
5. Do not interrupt existing utilities without Utility Owner's consent and, pending approval by the affected building users. Approval of affected users must be obtained at least 72 hours in advance of interruption.
6. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with appropriate utility provider or University Engineer for shut-
off of services if lines are active.

D. Protect structures, utilities, and all other improvements from damage during earthwork operations. If structures, utilities or other improvements are damaged, replace them in the same or better condition.

E. Water-Jet using a truck mounted system and videotape storm sewers where debris may have accumulated. Comply with Section 02722 requirements. This must be completed prior to acceptance by the University. University fire hydrants are not to be used for flushing purposes.

F. Contractor is required to maintain adjacent sidewalks and streets free of dirt accumulation arising out of earthwork.

PART 2 - MATERIALS

2.1 SOIL:

A. Earth backfill and earth fill shall be excavated material that is free from organic matter, roots, debris, and rocks larger than 3 inches in the greatest dimension.

B. If sufficient earthwork material to complete the work is not available at the site, the contractor shall secure his own source of material and necessary permits to complete the project requirements.

C. All soil materials to be used, whether from on or off-site, must be approved by the Soils Engineer as suitable for intended use and specifically for required location or purpose.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Follow the City of Boulder’s Design and Construction Standards, section 9.02(c).

3.2 SITE GRADING:

A. Perform earthwork to the lines and grades shown in the drawings. Shape, trim and finish slopes of channels to conform with the lines, grades and cross sections as shown. Remove exposed roots and loose rocks exceeding 3 inches in diameter. Round tops of banks to circular curves to not less than a 6-foot radius. Neatly and smoothly trim rounded surfaces. Do not over-excavate and backfill to achieve the proper grade.

3.3 SITE PREPARATION:

All sites to be occupied by permanent construction or embankments shall be cleared of all logs, trees, roots, brush, tree trimmings, and other objectionable materials and debris. All stumps shall be grubbed. Subgrades for fills and embankments shall be cleared and stripped of all surface vegetation, sod, and organic topsoil. All waste materials shall be removed from the site and disposed of by and at the expense of the Contractor.
In natural areas where excavation will occur, strip all topsoil, or in the absence of topsoil, strip the top six (6) inches of surface material and store separately from other excavated materials.

For concrete walks, roadways, parking areas and road crossings, saw-cut existing pavement full depth to a true line before excavation.

3.4 STABILITY OF SITE EXCAVATIONS:

A. Slope sides of excavations to comply with local codes, EPA and OSHA requirements, and soil engineers recommendations. Shore and brace where sloping is not possible, or permitted.

B. Shoring:
   i. Any damage to new or existing pipes or structures resulting from settlements, heaving, water or earth pressures, slides, caving, or other causes, due to lack of shoring, sheeting, or bracing, or due to failure of shoring, or due to improper shoring, or due to any other negligence on the part of the contractor, shall be repaired at the contractor’s expense.

3.5 DEWATERING:

A. Remove surface and subsurface water from excavations. Do not allow water to accumulate in excavations. Do not use footing or foundation trenches for temporary drainage ditches. Coordinate with Owner where water is to be discharged.

B. If applicable, obtain and comply with discharge permit or recommendations from federal and state regulatory authorities, prior to commencing dewatering operations.

3.6 PLACEMENT AND BACKFILL:

A. Earthfills and Embankments
   To the maximum extent available, excess suitable material obtained from structure and trench excavations shall be used for construction of fills and embankments.

   All material deposited in fills and embankments shall be free from rocks or stones, brush, stumps, logs, roots, debris, and organic or other objectionable materials, and shall be wetted or dried as required and thoroughly mixed to ensure uniform moisture content.

B. Excavation is unclassified. Perform all excavation regardless of the type, nature, or condition of the material encountered to accomplish the construction. Do not operate earthmoving equipment within 5 feet of walls of existing structures or newly completed construction. Place and compact fill or backfill adjacent to concrete walls with hand-operated tampers or other equipment that will not damage the structure.

C. Backfill excavations as promptly as work permits, but not until completion of the following:
   1. Acceptance of construction below finish grade including, where applicable, dampproofing, waterproofing, perimeter drainage, perimeter insulation, and basement and first floor slabs unless foundations are braced to prevent damage and movement.
   2. Inspection, testing, approval, and recording locations of underground utilities.
D. Place backfill and fill materials in layers not more than 8" in loose depth for material compacted by heavy compaction equipment, and not more than 4" in loose depth for material compacted by hand-operated tampers.

E. Before compaction, moisten or aerate each layer as necessary to provide the optimum moisture content.

F. The University may employ a geotechnical engineer to perform independent tests for compaction, moisture content, etc. The contractor must improve of any work that does not meet the requirements of these specifications.

3.7 MOISTURE CONTROL OF BACKFILLS AND EMBANKMENTS:

During the compacting operations, maintain optimum practicable moisture content required for compaction purposes in each lift of the backfill material. Maintain moisture content uniform throughout the lift. Insofar as practicable, add water to the material at the site of excavation. Supplement by sprinkling the backfill material. At the time of compaction, the water content of the material shall be at optimum water content or within 2 percentage points above optimum. Aerate material containing excessive moisture by blading, discing, or harrowing to hasten the drying process.

3.8 COMPACTION:

A. Compact soil to not less than the following percentage of maximum dry density determined in accordance with either ASTM D698 or D1557.

1. Structural Fills Below Footings: Compact top 12" of subgrade and each layer of backfill or fill material to 100% maximum dry density.

2. Structural Fills Below Interior Slabs: Compact top 9" of subgrade and each layer of backfill or fill material to 95% maximum dry density.

3. Foundation and Retaining Wall Backfill: Compact each layer of backfill material to 95% maximum dry density.

4. Exterior Slabs, Steps, Walkways, Pavements: Compact top 6" of subgrade and each layer of backfill and fill material at 95% maximum dry density.

5. Lawn or Unpaved Areas: Compact top 6" of subgrade and each layer of backfill or fill material at 90% maximum dry density.

6. All Deep Fill Areas (Fills Over 12 ft Depth): Comply with above requirements, except compact each layer of backfill or fill material between 98% and 100% maximum dry density.

3.9 FIELD QUALITY CONTROL:

A. Quality Control Testing During Construction:

1. Allow testing service to inspect and approve subgrades and fill layers before further construction work is performed.

2. Testing agency will test as follows: Field density tests in accordance with ASTM D2922
or D1556. Check calibration curves furnished with moisture gages in accordance with ASTM D3017.

Contractor will schedule the subsequent compaction tests during the course of the work by contacting the soils testing firm and setting the date and time for the testing. Testing frequency shall be determined by the soils engineer, however the frequency shall not exceed more than 150 linear feet in trenching holes. Various depths shall be observed and tested by the soils testing agency during the backfill operations.

3. Coordinate with the Owner to schedule initial testing of first lifts of structural fill. Owner reserves the option to provide continual observation.

4. Project Manager to provide test results to Parking and Transportation Services (PTS) when impacting parking facilities.

B. Test Evaluation:

1. If in opinion of the Architect, based on testing service reports and inspections, subgrade or fills which have been placed are below specified density, provide additional compaction and testing at no additional cost to Owner.

3.10 SETTLING:

A. Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn or other finish), excavate as directed, add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

B. All backfill shall be maintained in a satisfactory condition and all places showing signs of settlement shall be filled and maintained for a period of one (1) year following the date of final acceptance of all work. When the contractor discovers or is notified by the Owner that any backfill is not in compliance with the project standards, the contractor shall correct such conditions. The contractor shall repair any utilities and road surfacing damaged by such settlement to the satisfaction of the Owner. In addition, the contractor shall be responsible for the cost to the Owner of all claims for damages due to settlement of backfilled areas.

3.11 DISPOSAL OF EXCESS AND WASTE MATERIALS:

A. No area is available adjacent to the site for storage of excess fill material.

B. Trash, debris, waste and excess materials shall be removed from the Owner’s property and legally dispose of by the contractor at his expense.

END OF SECTION 02200
SECTIO 02221
TRENCHING, BACKFILLING, COMPACTING

PART 1 - GENERAL

1.1 SUMMARY:

A. Section Includes:

1. Trenching, backfilling and compacting in connection with the construction of underground utilities and appurtenances for work outside of building lines including the following:

   a. Water lines.
   b. Sanitary sewer lines.
   c. Storm sewer lines.
   d. Natural gas systems.
   e. Direct-bury steam systems.
   f. Direct-bury chilled water systems.
   g. Direct-bury compressed air systems.
   h. Direct-bury electric lines.
   i. Direct-bury telephone and data lines.
   j. Other utilities as shown in the Contract Documents.
   k. Utility tunnels.

2. Pavement removal and replacement.

B. Related Sections:

1. Section 01400 - Quality Control.
2. Section 02010 - Subsurface Exploration.
3. Section 02110 - Site Clearing.
4. Section 02111 - Tree and Plant Protection
5. Section 02200 - Earthwork.
7. Section 02513 - Asphaltic Concrete Paving.
8. Section 02520 - Portland Cement Concrete Paving.
10. Section 02667 - Chilled Water Systems.
12. Section 02695 - Steam Distribution Systems.
13. Section 02722 - Drainage Structures and Piping.
15. Section 02785 - Electric Power Transmission.
16. Section 02790 - Communication Transmission.
17. Section 02795 - Compressed Air Systems.
18. Division 15 - Mechanical: Additional requirements for mechanical work.
19. Division 16 - Electrical: Additional requirements for electrical work.
1.2 INTENT:

1.3 CODES AND STANDARDS:

A. The most recent City of Boulder Design & Construction Standards are incorporated by reference into the University’s Standards. When there is a conflict between standards, the more stringent requirement shall apply. The University’s Civil Engineer must approve in writing any deviation from these standards prior to construction.

1.4 QUALITY ASSURANCE:

A. Requirements of Regulatory Agencies:

1. Perform excavation work in conformance to the requirements herein specified. Refer to the City of Boulder, Colorado Design and Construction Standards, Oct. 17, 2000 edition, for work not covered in this specification. The University of Colorado at Boulder Utilities Engineer shall approve the use of particular City of Boulder standards.

2. Supply, install, and remove all shoring as may be required to comply with all OSHA and EPA safety regulations and to maintain earth banks until backfill is placed.

3. Backfilling and construction of fills and embankments during freezing weather shall not be done except by permission of the Owner’s Representative. No backfill, fill, or embankment materials shall be installed on frozen surfaces, nor shall frozen materials, snow or ice be placed in any backfill, fill, or embankment.

B. Testing and Inspection:

1. Conform testing and inspection of backfill to the requirements of Section 02200. Make in place density tests at intervals and locations as directed by the Owner’s Representative.

2. All tests required for preliminary review of materials shall be made by an acceptable independent testing laboratory at the expense of the contractor. Two(2) initial gradation tests shall be made for each type of pipe bedding, fill or backfill material, and one (1) additional gradation test shall be made for each additional 500 tons of each material. Retests of samples failing initial tests shall be at the expense of the contractor. Initial moisture density (Proctor) tests and relative density tests on the materials, and all in-place field density tests shall be made at the expense of the Owner.

1.5 SUBMITTALS:

A. Submit six copies of a report from a testing laboratory verifying that material conforms to the specified gradations or characteristics.

B. Submit method of compaction in pipe zone including removal sequence of shoring where used.

1.6 PROJECT/SITE CONDITIONS:

A. Protection:
1. Protect existing utilities, adjacent property, and utility excavations, including hand excavation, in accordance with the requirements of Section 02200.

B. Sleeving:
1. Verify all required utility sleeving is installed and properly located and supported prior to backfilling.

PART 2 – PRODUCTS

2.1 GENERAL:
A. All bedding and backfill material shall have the approval of the Owner’s Representative, and shall be free of frozen material, organic material and debris.

B. Bedding materials shall contain no cinders or other material which may cause pipe corrosion.

C. Squeegee sand conforming to the gradation for RCP Sewer Pipe may be used as bedding material for other types of pipes, subject to approval by Owners Representative’s.

D. Reuse of on-site material is subject to Owner Representative’s approval.

2.2 BEDDING AND BACKFILL:
A. Fill and Backfill Materials
1. Earth, loam, sandy clay, sand and gravel, soft shale, or other acceptable materials which are free from organic matter and large clods of earth or stone, may be used for fill. Material shall be moistened as required to facilitate backfilling.
2. If the job excavated material proves to be unsuitable for backfill, the contractor may, if approved by Owner’s Representative, use a pit-run material consisting of rocks less than three (3) inches in diameter and a maximum of 20% passing a No. 200 sieve.

B. Select Backfill:
1. Suitable material with no stones greater than 1" diameter for concrete pipe and 0.75" diameter for all other pipe. Excavated material which meets the grading requirement may be used for select backfill.

C. Follow the City of Boulder’s Design and Construction Standards, section 9.02

D. Granular Bedding Materials for Ductile Iron Pipe and PVC Pressure Pipe.
1. This material shall be as outlined in the City of Boulder’s Design and Construction Standards, Chapter 9.

E. Bedding Material Within Building Lines.
1. The pipe shall be carefully bedded in accordance to the above gradations except within building lines where 6” pea gravel shall be used to surround the pipe. Pea gravel shall be rounded gravel, graded with less than 10% passing a N. 200 sieve, less than 50% passing a No. 4 sieve, and having a maximum particle size as follows:

<table>
<thead>
<tr>
<th>Type of Pipe</th>
<th>Max. Particle Size (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ductile iron</td>
<td>3/4</td>
</tr>
<tr>
<td>Concrete or concrete cylinder</td>
<td>3/4</td>
</tr>
<tr>
<td>Fiberglass</td>
<td>3/4</td>
</tr>
<tr>
<td>VCP</td>
<td>3/4</td>
</tr>
<tr>
<td>Steel pipe 3 inches and smaller</td>
<td>1/4</td>
</tr>
<tr>
<td>Steel pipe larger than 3 inches</td>
<td>3/4</td>
</tr>
</tbody>
</table>

F. Flow Fill

1. Low Strength Concrete (LSC) is defined as Flow Fill in these standards.
2. Materials, batching, mixing and delivery shall be in accordance with the Colorado Department of Highways Standard Specifications for Road and Bridge Construction and shall meet the specific requirements outlined in the City of Boulder’s Design and Construction Standards, section 9.02.
3. The maximum desired 28-day compressive strength is 100 PSI (not a specification requirement).

G. Unsuitable Material:

1. Highly organic soil; ASTM D2487 Group PT, topsoil, roots, vegetable matter, trash and debris will not be used for any bedding, backfill or structural fill.

PART 3 - EXECUTION

3.1 SHORING AND BRACING:

A. Provide shoring and bracing as specified in the City of Boulder’s Design and Construction Standards, chapter 9.

3.2 DEWATERING:

A. Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding project site and surrounding areas.

B. Do not allow water to accumulate in excavations. Remove water to prevent softening of trench bottoms, and soil changes detrimental to stability of subgrades and foundations.

C. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

D. Convey water removed from excavations and rainwater directly to storm sewer lines only,
subject to approval by owner.

E. Do not use pipe or pipe trench excavations as temporary drainage ditches.

F. Refer to Section 02200 Part 3.5.

3.3 INSTALLATION OF PIPE BEDDING:

A. Pipe bedding material shall consist of the material as specified in this section. Bedding material shall be placed to the required elevation of the pipe invert. Tamping equipment shall be used to thoroughly tamp the bedding material. The moisture content of the material shall be within two (2) percent of optimum.

B. After bedding material has been placed and has been approved and after the pipe has been installed and approved the granular bedding material shall be installed to an elevation 12 inches above the top of the pipe. The granular bedding material shall be placed and compacted in distinct, separate lifts not to exceed six inches of loose depth; except that the first loose lift shall not be higher than the pipe centerline (springline). Compaction shall meet the above requirements utilizing T-bars or mechanical tamping equipment.

C. Set all pipe on compacted granular material supporting the lower half of the pipe barrel. Place compacted granular material around and on top of pipe to not less than 12” deep from top of pipe.

3.4 INSTALLATION OF TRENCH BACKFILL:

A. Unless otherwise authorized by the UCB Civil Engineer flowable fill shall be used for backfill under high traffic asphalt roadways. This includes, but is not limited to, any asphalt areas on 18th St., Colorado Ave., Kittredge Loop Rd., Discovery Dr., Euclid Ave., Wardenburg Dr., and Baker Dr.

B. The compaction requirements shall conform to maximum dry density according to ASTM D698, Moisture-Density Relations of Soils (Standard Proctor). When the ASTM D698 test is not applicable, the percentage compaction requirements shall conform to ASTM D2049 Test for Relative Density of Cohesionless Soils.

C. All backfill above the bedding installation shall be carefully placed and compacted. Compaction shall be by mechanical tamping in eight-inch maximum loose lifts using mechanical or hand tampers, suitable for material being compacted, or vibratory rollers. All backfill shall be compacted to 95% of maximum laboratory dry density or 70% relative density. The material shall be within two (2) percent of optimum moisture content.

D. The contractor may request approval of alternate means of compaction. Such request must be submitted to the Owner’s Representative in writing and the approval will be made by the Owner’s Representative in writing. Use of specified or approved compaction methods does not relieve the contractor from providing a complete project meeting the intent of the Design and Construction Standards.
E. When directed by the Owner’s Representative, the contractor shall excavate backfilled trenches for purposes to perform compaction tests at locations and depths determined by the Owner’s Representative. The contractor shall be responsible for reinstalling and compacting the test excavations at no additional cost to the Owner.

F. Do not backfill any pipe trenches until pipe is inspected by University Engineer and owning utilities (if any).

3.5 PLACEMENT OF FLOW FILL

A. Sufficient mixing capacity shall be provided to permit the flow fill to be placed continuously, without interruption.

B. Flow fill shall be thoroughly mixed prior to discharging to ensure a uniform product. Agitation is required during transportation and waiting time to ensure that the material is in suspension when placed.

C. Flow fill shall be discharged from the mixer truck into the trench to be filled, or by other methods approved by the Owner’s Representative.

D. The flow fill shall be placed continuously and brought up uniformly to a point a minimum of 1-inch above adjacent surfaces (trench walls) to ensure proper drainage of bleed water away from the trench.

E. Flow fill shall be vibrated during and after placement to accelerate the bleeding and evaporation of water and to improve consolidation of the material.

F. Flow fill shall not be placed on frozen ground.

G. Flow fill shall be protected from freezing until it has hardened.

H. When the bleed water subsides, the fill material shall be struck off level with the adjacent pavement and the surface finished with a wood float. After the fill material has sufficiently cured to support anticipated traffic loads, the roadway may be temporarily reopened to normal traffic. It shall be the Contractor’s responsibility to maintain the finished surface of the cured fill material in a safe and driveable condition, until such time that the roadway pavement section is permanently replaced. Alternatively, the Contractor may opt to remove the cured fill material to a depth equal to the bottom of the existing pavement, and install a temporary asphalt concrete patch. The foregoing does not preclude permanent pavement restoration immediately after the fill material has sufficiently cured to support anticipated traffic loads, should construction scheduling so permit. Permanent pavement restoration shall be in accordance with these specifications.

I. Flow fill mixing and placement may be started if weather conditions are favorable, when the air temperature in the shade and away from artificial heat is at least 34 degrees Fahrenheit and rising. Mixing and placing shall stop when the air temperature in the shade and away from artificial heat is 38 degrees Fahrenheit or less and falling, and in no case shall flow fill be placed when the air temperature is lower than 34 degrees Fahrenheit.
J. It shall be the Contractor’s responsibility to ensure that the backfilled trench is not exposed to vehicular traffic loads until such time that the fill material has sufficiently cured to support the anticipated vehicle loads. Prior to reopening the roadway to normal traffic, the Contractor shall subject the fill material to a vehicular test load that is reasonably representative of the ultimate loading anticipated. When the fill material supports such vehicular test load without apparent deformation, said fill material shall be deemed sufficiently cured to permit reopening of the roadway to normal traffic.

K. Should it be necessary to reopen the roadway to normal vehicular traffic, before the fill material has sufficiently cured to support the anticipated traffic loads, it shall be the Contractor’s responsibility to provide and install steel plates to bridge over the trench.

3.6 PAVEMENT REMOVAL AND REPLACEMENT:

A. Asphalt Pavement:
   1. Score existing surface with a cutting wheel to create clean break line. Leave 6" undisturbed subgrade lip on each side of trench.
   2. Compact aggregate base course to 95% per AASHTO T180. Replace pavement in accordance with permit requirements or minimum thickness specified in Section 02513. Compact asphalt to 95% per ASTM D1559.

B. Concrete Pavement:
   1. Sawcut existing concrete. Leave 6" undisturbed subgrade lip on each side of trench.
   2. Compact aggregate base course to 95% per AASHTO T180. Replace pavement in accordance with permit requirements or minimum thickness specified in Section 02520.

C. Sidewalk and Curb Removal
   1. Cut curbs and sidewalks prior to excavation of the trenches with a pavement saw or pavement cutter. Leave 6" undisturbed subgrade lip on each side of the trench. Haul concrete materials from the site. Do not use for trench backfill.

3.7 FIELD QUALITY CONTROL:

A. Comply with Section 02200 requirements.

END OF SECTION 02221
PART 1 - GENERAL

1.1 SUMMARY:

A. Section Includes:
   1. Utility tunnels for steam and condensate piping, chilled water piping, compressed air piping, telephone and data raceway systems, and other systems as applicable.

B. Related Sections:
   1. Section 02200 - Earthwork.
   2. Section 02221 - Trenching, Backfilling, Compacting.
   4. Section 02695 - Steam Distribution Systems.
   5. Section 02785 - Electric Power Transmission.
   6. Section 02790 - Communication Transmission.
   7. Section 02795 - Compressed Air Systems.

1.2 SYSTEM DESCRIPTION:

A. Cast-in-place concrete for lid, walls and floor. Provide non-slip texture on floor:

B. Waterproof lid and floor.

C. Waterproof or dampproof walls as appropriate to water table.

D. Provide 4" minimum gravel subgrade below floor.

E. Provide floor sloped a minimum of 0.125" to 0.25" per foot to floor drains connected to sanitary sewer system, or sump as conditions may require.

F. Provide sufficient lighting to achieve a minimum of 20 footcandles in all locations.

G. Provide access hatches at 100 ft. o.c. of size acceptable to the University of Colorado at Boulder Utility Engineer. Provide units for H2O loading where subject to vehicle traffic.

H. Layout piping and other utilities as acceptable to the University of Colorado at Boulder Utility Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Comply with applicable requirements of other Division 2 through 16 sections.
PART 3 - EXECUTION

3.1 INSTALLATION:

A. Comply with applicable requirements of other Division 2 through 16 sections.

END OF SECTION 02300
SECTION 02400

GENERAL UTILITY REQUIREMENTS:

PART 1 – GENERAL

1.1 SUMMARY:

A. Section Includes:
   1. Submittals
   2. Inspections
   3. Procedures

B. Related Sections:
   1. 02200 – Earthwork
   2. 02221 – Trenching, Backfilling, & Compaction
   3. 02300 – Utility Tunnels
   4. 02665 – Water Systems
   5. 02667 – Chilled Water Systems
   6. 02685 – Gas Distribution Systems
   7. 02695 – Steam Distribution Systems
   8. 02711 – Foundation Drainage
   9. 02722 – Drainage Structures & Piping
  10. 02730 – Sanitary Sewer Systems
  11. 02785 – Electric Power Transmissions
  12. 02795 – Compressed Air Systems

1.2 INTENT:

A. The intent of this standard to state the general utility requirements that apply to all utilities on the UCB campus.

1.3 CODES & STANDARDS:

A. The most recent City of Boulder Design & Construction Standards are incorporated by reference into the University’s Standards. When there is a conflict between standards, the more stringent requirement shall apply. The University’s Civil Engineer must approve in writing any deviation from these standards prior to construction.

B. The most recent International Plumbing Code

C. The most recent International Building Code

1.4 PERMITS:
A. Each project which disturbs or modifies an underground utility is required to obtain a Utility Permit from the University’s Facilities Management Department prior to commencing construction.

B. The project is responsible for paying any permit fees associated with the Utility Permit.

1.5 TAP FEES

A. The project is responsible for paying any tap fee (also commonly referred to as an impact fee or a plant investment fee (PIF)) as determined by the University’s Facility Management – Civil Division. Please reference the utility fee schedule.

1.6 SUBMITTALS

A. During Schematic Design, the design engineer shall provide a preliminary utilities plan which:
   1. Illustrates proposed methods and alternatives for providing utility service for the project.
   2. Include site topography at 2-foot interval contours
   3. Illustrate existing utilities, including manholes, within 400 feet of the proposed development.
   4. Identify features, such as creeks, drainage facilities, wetlands, floodplain, utility tunnel, and irrigation ditches, that might influence the location of underground utilities.
   5. Illustrate the general layout of the proposed utilities including mains and manhole locations.
   6. Illustrate a demolition plan which clearly identifies which utility lines are to be abandoned.

B. During Design Development, the design engineer shall submit a Utility Report to the University’s Civil Engineer. This report shall conform to the requirements outlined in the City of Boulder’s Design & Construction Standards for the utility report. The engineer shall submit a utility system analysis showing the impacts of the project on the utility services. In addition, the following items shall be included for review:
   1. Demolition plans,
   2. Utility plans showing new and existing utilities,
   3. Utility details, and
   4. An outline specification

C. Construction Document Phase, the design engineer shall submit complete plans and specifications for review which include:
   1. Pipe sizes
   2. Points of connection
   3. Valve details,
   4. Thrust blocks (including area)
5. Thrust (restraint) rods (including diameter),
6. Supports,
7. Trenching and bedding details,
8. Hydrant details,
9. Connection and joint details,
10. Vault plans and sections,
11. All existing tunnels and utilities,
12. A demolition plan indicating which lines are to be abandoned,
13. Building penetration details, and

D. Prior to construction:
1. A copy of the manufacturer’s installation recommendations for each kind of pipe must be provided to each foreman and the inspector prior to construction and must be followed during construction unless otherwise instructed.
   b. Manufacturer’s description of admixtures used.
   c. Manufacturer’s report of visual inspection.
2. Submit a copy of the project’s Stormwater Management Plan (SWMP) for review and approval. Use Best Management Practices (BMP’s). Sediment, debris or other pollutants from construction operations must be managed to prevent flow to the storm drainage system(s). Erosion and sediment management practices must be applied during construction.
3. Submit a copy of the project’s dewatering permit, if applicable.
4. Submit proposed modifications to any existing pre-engineered concrete structure (i.e., manhole, catch basin, or vault). Submittal shall show dimension of any holes and method for preventing excessive damage.
5. Shop drawings
6. Prior to delivery of pipe from each manufacturing lot or run, submit:
   o Test results for external load crushing strength test per Section 11 of ASTM C76 or Section 10 of ASTM C655.

E. At project closeout:
Record Drawings: The Contractor shall safely maintain in good working order at the project site, one copy of all approved plans, specifications, addenda, written amendments, change orders, work change directives, field orders, and written interpretations and clarifications, clearly annotated to describe all changes made during construction. These documents, together with all final samples and Shop Drawings, shall be available for reference at the request of the University. Upon completion of the work, any deviations from the approved design and any pertinent notes and comments regarding construction conflicts shall be transferred to the approved plans and electronic drawing files and subsequently submitted to the University as the “Record Documents” for the project.
1. Submit record drawings of installed utility system piping and products, in
2. Submit shop drawings in accordance with the Section 01300.

1.7 NOTIFICATIONS:

A. Notify the CU Project Manager:

1. Not less than 48 hours before performing locates.

2. Not less than 48 hours before commencing work.

3. Not less than 24 hours before laying pipe.

4. Not less than 48 hours before any testing required by these standards.

5. At substantial completion

6. Not less than 48 hours before final inspection.

1.8 INSPECTIONS:

A. Notify the Owner’s Representative not less than 48 hours before inspection time.

B. Inspections are required prior to the following installation activities.

1. **Stockpiled Materials** – Verify that materials meet construction drawings and approved submittals, including but not limited to: bedding material, pipe, fittings, valves, valve boxes, and fire hydrants.

2. **Excavation** – Verify proper trench depths, shoring, spoil pile location, dewatering, and location and protection of existing utilities.

3. **Installation** – Verify proper bedding depth, alignment and grade, clean pipe and lubricants. Inspect piping to determine whether line displacement or other damage has occurred. If inspection indicated poor alignment, debris, displaced pipe, infiltration or other defects, correct such defects, and re-inspect. Inspection of rebar for cast-in-place manhole bases.

4. **Backfill and Compaction** – Verify proper methods of backfill and compaction, depths of lifts, moisture control, backfill material free of large rock and organic or frozen material, and proper compaction effort and passing tests. Verify that warning tape has been installed. Verify that tracer wire has been installed and that it has a passing continuity test.

5. **Testing** – Verify that testing methods comply with UCB Design and Construction Standards. Verify that the Utility Inspector has witnessed all pressure tests of pipe, vacuum testing of manholes, televising of storm and sanitary sewers, and any other testing requirements such as deflection testing the may be required in the project specifications.

6. At any other time required by the contract documents.

C. Final inspection will be performed at completion at final stabilization of grade.
D. If work to be inspected is covered up prior to inspection, and if the University considers it necessary or advisable that covered work be observed, inspected, or tested, the Contractor, at the University’s request, shall uncover, expose, or otherwise make available for observation, inspection, or testing by the University, that portion of the work in question, furnishing all necessary labor, material, and equipment at no cost to the University.

E. If directed, the Contractor shall promptly correct all defective work, whether or not fabricated, installed, or completed, or, if the work has been rejected, remove it from the site and replace it with work that is not defective. The Contractor shall pay all claims, costs, losses, and damages caused by or resulting from such correction or removal (including, but not limited to, all costs of repair or replacement of work by others).

1.9 QUALITY ASSURANCE:

A. Manufacturer's Qualifications:

1. The manufacturer(s) shall be a firm regularly engaged in manufacture of water system materials and products, and whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications:

1. The installation firm(s) must submit documents of qualification and have a minimum of 3 years of successful installation experience on projects with work similar to that required for project.

1.10 SEPARATION OF UTILITIES:

B. Parallel (Horizontal) Separation: Parallel separations between utility mains and services to provide for adequate trench excavations and maintenance operations shall be as follows. All distances are measured from outside of pipe to outside of pipe:

<table>
<thead>
<tr>
<th></th>
<th>Water</th>
<th>Sewer</th>
<th>Storm</th>
<th>Electric, Telecommunications, and/or Gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>10-ft</td>
<td>5-ft</td>
<td>5-ft</td>
<td></td>
</tr>
<tr>
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<td>5-ft</td>
<td>5-ft</td>
<td>5-ft</td>
<td></td>
</tr>
</tbody>
</table>

1. If the minimum horizontal separation between wastewater pipe and other utility cannot be achieved, then either the wastewater pipe or the other utility
pipe should be upgraded to a pressure class pipe for the distance where the minimum separation cannot be achieved.

2. The Utility Engineer may approve any deviation from the minimum separation distances on a case-by-case basis.

B. Pipe Crossings (Vertical) Separation

1. The minimum vertical separation between water and wastewater line crossings, as measured outside of pipe to outside of pipe, shall be 18 inches. The water line shall be constructed above the wastewater line.
   a. If the 18 inches of vertical separation cannot be obtained, the wastewater line shall be constructed of pressure-class pipe for at least 10 feet beyond each side of the water line crossing, measured from the center of the water line.
   b. If the water line cannot be constructed above the wastewater line, then the wastewater line shall be constructed of pressure-class pipe for at least 10 feet beyond each side of the water line crossing, measured from the center of the water line.

2. The minimum vertical separation between water and storm drainage line crossings shall be 18 inches, measured from outside of pipe to outside of pipe.
   a. If the 18 inches of vertical separation cannot be obtained, the storm drainage line shall be constructed of pressure-class pipe for at least 10 feet beyond each side of the water line crossing, measured from the center of the water line.

3. The minimum vertical separation between wastewater and storm drainage line crossings, as measured outside of pipe to outside of pipe, shall be 6 inches, including the following:
   a. If the storm drainage line is constructed below the wastewater line, then pressure class pipe will be required for ONE of the utility lines to prevent wastewater contamination of storm drainage.

4. When excavating under an existing utility, flowfill shall be used for backfilling under the utility pipe.

1.11 EROSION AND DUST CONTROL:

A. The Contractor shall prevent erosion of soil on the site and adjacent property resulting from utility construction activities. Effective measures shall be initiated prior to the commencement of clearing, grading, excavation, or other operation that will disturb the natural protection. Work shall be scheduled to expose areas subject to erosion for the shortest possible time, and natural vegetation shall be preserved to the greatest extent practical. Stormwater inlets shall be protected to prevent
sediment from excavated areas from entering. All BMPs shall be designed as to not restrict the inlets during large storm events which have the potential to cause flooding and damage to campus buildings.

B. If the Contractor is told that off-project area transport of dust is occurring during construction. The Contractor shall immediately increase the level of dust control to their construction activities.

C. It shall be the responsibility of the Contractor to investigate and verify in the field, the existence and location of utilities whether shown on the approved plans or not. The Contractor shall be solely responsible for the protection of all structures or utilities, including pipes, cables, fences or similar items. Permission for the adjustment of existing utilities or other items or structures shall be obtained from the appropriate owners or agents.

1.12 UTILITY LOCATES FOR OUTSIDE CONTRACTORS/PROJECTS:

A. Underground Utility locates must be requested through the Utility Notification Center of Colorado (UNCC) at 1(800) 922-1987 or 811. The contractor may contact the University of Colorado representative in charge of locating for general site information at (303) 961-0875.

B. The contractor must wait 2 business days (not to include the call day) from the time the locate request was made before excavation can commence per Colorado State Law. Under no circumstance other than an emergency is it allowable to commence excavation before this stated time frame.

C. Emergency utility locates must be requested through the Utility Notification Center of Colorado (UNCC) at 1(800) 922-1987 or 811. The contractor may also contact the utility locator directly at (303) 961-0875 during regular business hours. The contractor must give the utility locator 2 hours to respond in person or by telephone. Under no circumstance should excavation commence unless the contractor has spoken with the utility locator and contacted the UNCC. If for some reason the utility locator cannot be reached, the contractor could contact the Facilities Management Service Center at (303) 492-5522 for assistance.

D. Non-University entities that have utilities on the University property are responsible for their own utility locates. The contractor must make sure that these entities have been notified and have shown up before any digging starts.

E. The dig area(s) must be pre marked with white paint. The only exception to this rule is if the contractor meets with the utility locator to point out the specific dig area(s). The contractor must also make every attempt to adequately describe the area when the utility locate is called into the UNCC. Building names and landmarks are extremely helpful when describing campus locations. Each building on campus
1.13 DAMAGE NOTIFICATION. IF A FACILITY IS DAMAGED, THE FOLLOWING DAMAGE NOTIFICATION PROCEDURE SHALL BE FOLLOWED:

A. Immediately evacuate the area and call 911 if a dangerous or potentially dangerous situation exists.

B. Cease excavation and immediately notify the CU representative to report damage or exposed facility. Assist CU representative in completing a damage report.

C. Immediately call UNCC (1-800-922-1987 or 811) and process a Damage Ticket.

D. Contact facility owner(s) and report the damage.

A. Excavators and owners/operators who fail to use reasonable care will be “presumed liable” for the cost of the damage, including expenses of suit and reasonable attorney fees and any third party injuries or damages. Reasonable care should include all of the guidelines identified under excavator and facility owner/operator responsibilities.

F. Continue excavation only after a facility representative has arrived and given permission to proceed.

1.14 UTILITY TRACE WIRE

A. General Requirements:

1. Every trace wire system installed should have been designed to match the life of the utility it accompanies.

2. The trace wire needs to be continuous, insulated from the earth and grounded on its ends. NO below ground connections accepted.

3. The trace wire should have a minimum 12 AWG size or use NEPTCO RT Series Detectable MuleTape, constructed of solid copper and have a minimum 30 mil polyethylene jacket designed for buried use. The use of solid copper wire type THHN or THWN VW-1 600V, gasoline and oil resistant insulated is the minimum requirement for trace wire.

4. Trace wires must be installed on all underground utility lines that are being installed or replaced if the section of the utility line is 20 feet or more in length.

5. Both trace wire ends must be accessible from the surface and protected in a flush-mounted trace wire box (Snake Pit Magnetized Box). Trace wire boxes must be installed along the utility line every 250 feet. Trace wire boxes must also be installed adjacent to outside walls where utilities enter the building. The trace wire box must be identified as a trace wire box on the outside. The trace wire
B. Installation in the Trench

1. The trace wire should not float “somewhere in the trench.” The trace wire will not be wrapped around the pipe in a spiral as this is a source of signal degradation and adds physical stress to the wire. The trace wire will be placed on top of the utility pipe and will be fastened in place at approximately every 8 to 12 feet to secure it in place when the trench is backfilled. Metallic Fasteners are not to be used. The trace wire on fuel pipelines and on gas lines will not be fastened to the top of the pipe. Instead, the wire will be fastened to the pipe with the use of a spacer to keep the wire at a set distance from the pipe.

2. The wire will be allowed some slack to allow for bends in laying and for future installation of joints, splices, tapping saddles, etc. The slack should also be sufficient to allow small earth movements occurring in compacting trench fill or through natural subsidence.

3. If it is necessary to join the trace wire below ground, the wire should be joined in a permanent bond (braising, cad welding or equivalent) and the joined area insulated and rendered watertight in order to prevent corrosion.

C. Installation of Trace Wire Access Points

1. Any trace wire system will be accessible at a minimum of 2 points, the beginning and the end of the wire. The general design of access points to tracer wire is that the wire will be brought to ground level and a connection point provided for a locator to clip equipment onto the wire. If the contractor laying the new utility needs to join sections of tracer wire, these access points are considered an above ground join and do not need to be extensively insulated. Split bolts (preferred) and wire nuts are options. The join can be taped also.

2. Trace wire in valve boxes are vulnerable to being twisted around valve keys and snapped, or pushed to the bottom of the valve box where they are out of reach and inaccessible to the locator. The problem can be mitigated by correctly installing the trace wire so it enters the valve box near the top where it can be coiled just under the valve cap. This way the utility worker can easily pull the loop out of the way before using the valve.

D. Distance Between Access Points

1. Access to trace wire will in general be at every point the utility has another physical access point. On water, gas and fuel lines all valves below ground are considered access points and trace wire should be accessible at these points. Access points’ distance from each other will thus vary from a few feet up to hundreds of feet.
2. There normally should be an access point at least every 500 feet. On long utility runs that exceed 500 feet there should be an intermediate access point provided by bringing the trace wire to the ground level and installing an above ground accessible junction box. Where this is a problem the trace wire system may be initially designed with cable that can be demonstrated to carry an adequate signal over longer distances.

E. Termination of Trace Wire

1. The beginning and end of a tracer wire are equally logical places to be brought to the surface. Above ground trace wire termination points will be clearly tagged or labeled as end points. An as-built point-to-point wiring diagram will be provided and mounted next to the termination point. The end points of any trace wire system are also suitable points to place anodes. Anodes have the dual function of providing cathodic protection for the trace wire (thus increasing its life expectancy) and for providing high quality grounds points.

2. Where a new non-metallic utility line taps into an existing metal utility line, the tracer wire should be either terminated at an anode next to the metallic utility or be permanently attached to the metallic line. A tracer wire will not be terminated to or on another tracer wire or metallic utility line unless the two systems are demonstrably compatible. This is to reduce the potential for rapid corrosion of one system due to a ‘reverse’ cathodic effect.

3. Lateral connections will be designed to be compatible with the trace wire on the main line. If the termination of the lateral at the main line tracer wire is underground, the join will meet all requirements for underground joins applicable to the main line tracer wire. If the join is ‘above ground’, e.g. at a valve for the lateral line, the joint will be a permanent one (split bolt or better) to the main line tracer wire and will be accessible.

4. Where the lateral line effectively terminates/interfaces with a building, the lateral tracer wire line section will be terminated in an appropriate manner for the utility. Where the utility enters a meter, junction box or similar point outside the building, the trace wire should be brought to the surface and terminated by attaching it to the appropriate utility with a suitable fastener/clamp so that it is clearly visible as part of the utility installation (no dangling wires). When the utility access is only available inside the building, the tracer wire will be terminated in a neat manner inside the building and clearly labeled or tagged. It will also need to be grounded.

F. Testing of Trace Wire Systems

1. All trace wire for new utility installations will be tested before acceptance. The test will take the following form:
a. A standard 5 watt generator will be used to provide an AC current on the wire.
b. The frequency of the signal from the generator will be initially restricted to 33 kHz or less.
c. A standard hand held detector will be used to trace the signal.

2. The installed trace wire will be deemed to pass the test if using this set up:
   a. The trace wire is accessible at all access points.
   b. The trace wire can be traced from access point to access point.
   c. Widely-spaced access points can be traced out in the worst case from each ‘end’ to a common meeting point between them.
   d. Depth readings are consistent and accurate to within a 15 to 1 depth to diameter ratio.

PART 2 – PRODUCTS
   Not Used

PART 3 – EXECUTION
   Not Used

END OF SECTION 02400
SECTION 02515
UNIT PAVERS

PART 1 - GENERAL

1.1 SUMMARY:
A. Section Includes:
   1. Unit pavers.
      a. Loose laid concrete pavers.

1.2 SUBMITTALS:
A. Samples:
   1. Submit two sets of 5 units each for each type and color of paver required, showing full range of colors and textures.

B. Mock-Up:
   1. Use materials, pattern and joint treatment indicated for project work. Include special features for expansion joints and contiguous work.
   2. Build mock-up in form of panel at the site, in location indicated or directed, of full thickness and approximately 4' x 3'.
   3. Obtain Architect's and Owner's acceptance of visual qualities of mock-up before start of unit paver work.
   4. Retain mock-up during construction as a standard for judging completed unit paver work. Do not move or destroy mock-up until work is completed.

1.3 QUALITY ASSURANCE:
A. Provide materials obtained from only one source for each type and color of pavers.

PART 2 - PRODUCTS

1.4 PAVERS:


PAVER SELECTIONS HAVE BEEN MADE TO PROVIDE A UNIFORM APPEARANCE ACROSS THE MAIN CAMPUS. DESIGNER MAY REQUEST VARIATION FROM UCB STAFF. FOLLOWING SELECTIONS APPLY ONLY TO MAIN CAMPUS.
1.5 SETTING BED SAND:

A. Sand conforming to ASTM C144 except 100% passing 0.375” sieve, 90% to 96% passing No. 4 sieve, 10% to 30% passing No. 100 sieve and not more than 3% passing No. 200 sieve.

1.6 ACCESSORIES:

A. Paving Fabric: Dupont Typar 3401 or Celanese Mirafi 140N.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Use of paver units which are chipped, cracked, or discolored is not acceptable. Units damaged after installation shall be replaced.

3.2 LOOSE LAID INSTALLATIONS:

A. Provide paving fabric placed on smooth, prepared soil subbase with side and end joints lapped not less than 3”.

B. Provide sand setting bed for pavers. Compact sand bed by tamping or wetting and screed to 2” minimum depth or as required to allow for setting of pavers. Avoid damage to paving fabric.

C. Lay out work to minimize cutting.

D. Surface must be uniform with an even plane surface. Units with a deviation between them of more than 1/16” will be unacceptable. Units that vary more than 3/16” in vertical position when tested with a ten foot straightedge are unacceptable.

END OF SECTION 02515
SECTION 02520
PORTLAND CEMENT CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY:

A. Section Includes:
   1. Concrete paving.
   2. Curbs and gutters.
   5. Dumpster pads at all new trash collection facilities.

B. Related Sections:
   1. Section 02200 - Earthwork.
   2. Section 03300 - Cast-in-Place Concrete.

1.2 INTENT:

1.3 CODES & STANDARDS:

A. The most recent City of Boulder Design & Construction Standards are incorporated by reference into the University’s Standards. When there is a conflict between standards, the more stringent requirement shall apply. The University’s Civil Engineer must approve in writing any deviation from these standards prior to construction.

1.4 SYSTEM DESCRIPTION:

A. For handicap accessible curb ramps, conform to the Campus Standard Curb Ramp detail following this section.

1.5 SUBMITTALS:

A. Shop Drawings: Submit sections and details where not fully dimensioned on the drawings.

B. Manufacturer's Data: Submit for proprietary products.

C. Mix Design: Submit mix design for review by the Architect / Engineer

D. LEED MRc5: Regional Materials
   Provide a statement from the manufacturer stating the materials provided were manufactured within a 500 mile radius of the project site. Include the location in the submittal.

1.6 QUALITY ASSURANCE:
A. Record of Work: Provide record of time and date of placement, temperature, and weather conditions.

B. Conform to applicable requirements of ACI 301.

1.7 JOB CONDITIONS:

A. Cold Weather: Cease concreting when descending air temperature in shade and away from artificial heat falls below 35 degrees F., and there is frost in subgrade.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Ready Mixed Concrete: ASTM C94.

B. Cement: ASTM C150, Type I except use Type II or V as required by Soils Report, 6 sacks per cubic yard minimum.

C. Aggregates: ASTM C33, 0.75" maximum size.

D. Water: Potable.

E. Slump: 1" to 4".

F. Water Cement Ratio: 0.44-0.48 maximum.

G. Compressive Strength: 4000 psi minimum.

H. Admixtures:

1. Air Entraining Agent: ASTM C260, certified by manufacturer to be compatible with other required admixtures, to achieve 5 to 7 percent entrained air.

2. Water-Reducing Admixture: ASTM C494, Type A.

3. Recycled Content: 100% post-industrial fly ash.

   a. Up to 15%, by weight, of the portland cement may be substituted by fly ash.

   b. Fly shall not be used in concrete for sidewalks, curb ramps, curb and gutters, valley gutters, crossspans, concrete paths, driveway, storm drainage structures, and alley approaches.

4. Prohibited Admixtures: Calcium chloride or thiocyanate.

I. Reinforcing:
1. One type of reinforcing is required for all sidewalks/concrete paving subject to vehicle traffic or as additional structural capacity to bridge potential backfill/settlement zone (e.g. in the backfill zone around a new building).
   a. Reinforcing Bars: ASTM A615 and Supplement 1, Grade 60.
   b. Reinforcing Bars: ASTM A615 and Supplement 1, Grade 60, epoxy coated. Required for entrance and exit points to parking facilities.
   d. Fibrous Reinforcement: Collated fibrillated, polypropylene fibers containing no reprocessed olefin materials and having a tensile strength of 70,000 psi. Use 1.5 lbs. per cubic yard of concrete minimum. Subject to approval by the owner’s representative.

J. Joint Material: 0.5" thick, closed cell polyethylene foam, Texmastic "Vinyltex 3600", Sonneborn "Sonoflex F", or approved substitute.

K. Curing Materials:
   2. Liquid Membrane Type: ASTM C309, Type 1, Class B.

PART 3 - EXECUTION

3.1 PREPARATION:

A. Check for soft spots prior to setting forms. Remove soft yielding material and replace. Compact to specifications.

B. Test for crown and elevation by subgrade planer to assure specified thickness.

C. Forms shall be capable of supporting loads imposed by construction equipment:
   1. Maximum deflection of 1/4".
   2. Straight and free from warp, with maximum deviation of surface 1/8.

D. Set dowels, expansion joints, preformed construction joins, and header boards and preformed baskets.
3.2 PLACEMENT:

A. Deposit concrete near final position on grade with minimum segregation and without damage of subgrade.

B. Final surfaces shall not have holes or honeycombs.

C. Minimum Thicknesses:
   1. Sidewalks not Subject to Vehicle Traffic: 4".
   2. Sidewalks and Drives Subject to Vehicle Traffic: 6".
   3. Structurally Supported Slabs (Such as Over Tunnels): As required to meet potential loading conditions.
   4. Loading docks: 8"

3.3 FINISHING:

A. Use equipment designed to spread, consolidate, screed and float freshly placed concrete in one pass, providing well consolidated, homogeneous mixture, requiring minimum of hand finishing to meet surface tolerances.

B. Finished surface tolerances:
   1. Tested with 10' straight edge parallel to center line immediately following first floating of surface.
   2. Advance straight edge 5'; space under straight edge shall no exceed 3/16"
   3. Special finishes: Do not use special finishes such as colored concrete, exposed aggregate, etc. unless specific approval from UCB staff is obtained. Evaluation will be made on a job-by-job basis. Do not use metal nosings on exterior concrete stairs
   B. Curbs, gutter and cross pans finished with burlap drag or wood float. Do not plaster surfaces.
   C. Immediately after float finishing sidewalks and ramps, slightly roughen the concrete surface by brooming in the direction perpendicular to the main traffic route. Use fine hair fiber-bristle broom except on inclined slab surfaces provide a coarse, non-slip finish by scoring surface with a stiff-bristled broom, perpendicular to the line of traffic.

3.4 JOINTS:

A. Contraction joints, minimum depth 1/4 thickness of concrete. Space at even intervals and match existing adjacent work (if any).

B. Longitudinal joints in conformance with drawings.
C. Expansion joints with preformed joint filler in a vertical position, deviating not more than 1/4" from a straight line. Install at all existing and proposed structures projecting through, into, or against pavement, in accordance with drawings.

3.5 CURING:

A. Apply curing compounds, sheets, or burlap immediately after finishing and water film has evaporated from surface. Do not use liquid membrane type on surfaces to receive mortar bed finishes.

3.6 PROTECTION:

A. Protect fresh uncured surfaces from rain.

B. Cold Weather: Maintain temperature of concrete above 50 degrees F. for minimum five days from placement.

A. No vehicle loads exceeding design loading. No equipment permitted on new pavement until design strength is attained.

END OF SECTION 02520
PART 1 - GENERAL

1.1 SUMMARY:

A. Section Includes:

1. Water systems and appurtenances.

B. Related Sections:

1. Section 02200 - Earthwork
2. Section 02221 - Trenching, Backfilling, Compacting.
3. Section 02400 – General Utility Standards
4. Water service connections to building: Division 15 sections.

1.2 INTENT

A. The water systems standards establish minimum standards for providing and maintaining the University's water utility distribution system.

B. All modifications to the University's water utility distribution system shall conform to the University's master plan.

1.3 CODES & STANDARDS

5. The most recent City of Boulder Design & Construction Standards are incorporated by reference into the University's Standards. When there is a conflict between standards, the more stringent requirement shall apply. The University's Civil Engineer must approve in writing any deviation from these standards prior to construction.

6. 2006 International Plumbing Code

7. 2006 International Building Code

8. NFPA Compliance: Install fire protection water systems in accordance with NFPA 24 "Standard for the Installation of Private Fire Service Mains and Their Appurtenances."

9. UL Compliance: Provide fire hydrants that comply with UL 246 "Hydrants for Fire-Protection Service", and are listed by UL.

4. Contractor must obtain a permit to operate valves or hydrants from the University of Colorado at Boulder Utilities and Engineering Division. Where valves or hydrants are owned by a utility other than the University, Contractor must contact the owning utility and follow that utility's regulations for operating valves and hydrants.

5. Operation of Water System must at all times remain under the supervision of the University of Colorado at Boulder.

6. Use the City of Boulder's Technical Drawings for standard details.

PART 2 – DESIGN

2.1 DESIGN FLOW

1. Follow the design guidelines specified in the City of Boulder Design and Construction
Standards.

2. Fire flows shall be in accordance with the types of structures planned for the development and shall be reviewed and approved by the University Fire Marshal. Minimum fire flows shall be 1,500 gallons per minute (gpm) fully sprinklered multi-family dwellings, and 3,000 gpm for commercial and industrial buildings. All mains conveying water for potable consumption shall be sized to deliver adequate fire protection in accordance with the design criteria.

3. Network modeling shall be conducted with EPANet software, or an acceptable alternative hydraulic analysis program approved by the University. Friction losses shall be computed using the Hazen-Williams equation with all pipes set to a friction coefficient of $C=130$. The following model output shall be provided in the design report submitted in accordance with Section 02400 of these standards.

   A. Schematic of the system layout, preferably color-coded by diameter, identifying all labels (junctions, pipes, etc.).
   
   B. Fire flow report tabulating the residual pressure at each node in the system. Fire flows shall correspond to the highest hazard building represented at each node.
   
   C. Junction reports for the maximum hourly design condition and the maximum daily plus fire condition associated with the lowest residual pressure determined during the fire flow analysis. Results shall include, but not be limited to, junction label, elevation, pressure, and hydraulic grade line (HGL).
   
   D. Pipe reports for the maximum hourly design condition and the maximum daily plus fire condition associated with the lowest residual pressure determined during the fire flow analysis. Results shall include, but not be limited to, pipe label, length, diameter, Hazen-Williams $C$, flow rate, velocity, headloss, and friction slope.

4. The potable water main network shall be fully looped such that all service lines are supplied from at least two directions, unless otherwise approved by the University’s Utility Engineer. If approval is granted for a particular dead-end main, under no conditions shall the dead-end exceed 600 feet.

5. The minimum depth of cover for potable water mains and service lines shall be 4.5 feet over the top of water pipe. The minimum and maximum depths of cover to top of pipe for new installations shall be 5.0 and 8.0 feet, respectively, unless otherwise approved by the University Engineer. Where grade changes are made to the ground surface over existing potable mains, the minimum cover shall be 4.5 feet and the maximum bury depth 8 feet, unless otherwise approved by the University Engineer.

2.2 MATERIALS AND INSTALLATION

1. Construction of water-related public improvements shall be in compliance with these Standards. All pipe shall be of adequate strength to support the trench and AASHTO HS-20 highway loadings. The type of pipe to be installed shall comply with these Standards, and shall be based upon applicable design flows, pressures, site conditions, corrosion protection, and maintenance requirements.

2.3 VALVES

1. Separation: Valve separation along mains shall be no greater than 600 feet, measured along the alignment of the main.
2. Valve Locations: Valves shall be located near pipe intersections along all branches of the potable water main network, resulting in 3 valves at a tee and 4 valves at a cross. A valve should be located with 10 feet of a fire hydrant.

2.4 SEPARATION OF UTILITIES:

Comply with the City of Boulder’s Design and Construction Standards, Chapter 4, General Utilities Design.

2.5 CROSS CONNECTION REGULATIONS:

Comply with the City of Boulder’s Design and Construction Standards, Chapter 5, Section 5.11, Cross Connection Regulations.

PART 3 – CONSTRUCTION

Products
3.1 Water Pipe and Fittings:

Comply with the City of Boulder’s Design and Construction Standards, Chapter 9, Utilities Standards.

3.2 Accessories:

A. Water Meters:

1. Refer to UCB Standard 15430, Section 1.03, A.14
2. All water meters shall have the capability to be field calibrated.
3. All meters shall comply with AWWA and ANSI/NSF 61 standards.
4. All meters shall be equipped with automatic meter reading capability.
5. All Other Locations: Provide meter acceptable to the City of Boulder Water Department.

3.3 Gate valves, butterfly valves, and fire hydrants:

A. Comply with the City of Boulder’s Design and Construction Standards, Chapter 9, Utilities Standards.

B. Refer to City of Boulder’s Standard Details. The hydrant must comply with NFPA requirements for minimum distance from a building.

Execution

3.4 Backfill, Trenching, Pipe Bedding, Cleanup and Restoration:

A. Follow requirements as specified in Section 02221

B. Backfill: Place and compact cover material starting at top of pipe bedding extending upwards to a distance of 1 ft. above top of pipe. Place in lifts which achieve a density of 95%, ASTM D1557 at a point 6” above top of pipe.

C. Restore pavements, curbs and gutters, utilities, fences, lawns, vegetation and other improvements to condition equal to or better than before work began and to satisfaction of Owner’s Representative.
D. Complete topsoil and reseeding of site, if required.

E. Remove and legally dispose of all excess waste materials off the Owner’s property.

3.5 Identification:

A. Underground Line Marker:
   1. During backfilling and top-soiling of underground piping, install continuous underground line markers, located at two (2) depths, 1’ below grade and 2’ above pipe.
   2. Manufacturer’s standard permanent, bright-colored, continuous-printed tape with metallic core, intended for direct-burial service; not less than 6” wide x 4 mils thick. Furnish blue tape with black printing reading "CAUTION WATER LINE BURIED BELOW".

B. Non-Metallic Piping:
   1. If non-metallic piping is used then provide tracer wire and test stations in compliance with COB’s Design and Construction Standards.
   2. Tracer wire shall be 12 gauge type UF, 600V single strand copper wire. Splices in tracer wires shall be “3M” Type DBY-6 low voltage for direct bury, and shall be waterproof gel cap type connectors.
   3. Tracer wire test stations shall be C.P. Mini Box stations measuring 2-1/2 inches in diameter and 18 inches high, or an approved equal.

3.6 Pipe Installation:
A. Comply with the City of Boulder’s Design and Construction Standards, Chapter 9, Utilities Standards.

B. Install copper pipe in accordance with CDA Copper Tube Handbook.

C. Care shall be taken to prevent contaminating materials from entering the water mains during construction or repair. Such materials that may accidentally enter the main shall be removed by flushing. This flushing shall be done prior to disinfection unless tablet method of disinfection used. If, in the opinion of the Owner’s Representative, the contaminated material that has entered cannot be removed by flushing, the interior of the pipe shall be cleaned by mechanical means and then swabbed with one (1) percent hypochlorite solution.

D. Handle pipe carefully to ensure delivery in a sound, undamaged condition. Inspect pipe for cracks, dents, abrasions or other flaws. The Owner’s Representative will reject damaged pipe on site. Contractor shall replace damaged pipe at no additional expense to the Owner. Do not store materials directly on ground.

3.7 Tapping Pipe:
A. Use experienced workers to make direct taps with tools in good repair and proper adapters for size of pipe being tapped. Drilling and/or tapping machines must be acceptable to Owner. Where the pipe to be tapped is owned by a utility other than the University, the Contractor shall contact and follow the regulations of the utility owner.

B. All taps must be made using the wet tap method, unless other methods are approved.
C. All foreign matter shall be removed from the interior prior to installation of tapping valves.

D. Tapping of existing pipe must be approved by the UCB Utility Engineer.

3.9 Field Quality Control:

A. Notify Architect, Owner and governing authorities (if any) at least 8 working hours in advance of pipe being laid in any trench and 16 working hours in advance of testing. Do not cover pipes until observed by Architect and approved by Owner and governing authorities (if any).

B. **Testing:** Testing of all pipe shall be tested as specified in Section 9.11 "Disinfecting of Waterlines" and 9.12, “Testing of Water Pipes,” of the City of Boulder’s Design & Construction Standards.

1. Pipe shall not be pressure tested until bacteriological testing meets the governing agency requirements. Pipe shall be backfilled prior to pressure and leakage tests.

3.10 Valves & Hydrants

A. Valves and hydrants shall be tagged “out of service” until the water system is operational. It is the responsibility of the contractor to notify the Boulder Fire Department regarding the location of the tagged hydrants.

END OF SECTION 02665
SECTION 02711
FOUNDATION DRAINAGE

PART 1 - GENERAL
1.1 SUMMARY:
   A. Section Includes:
      1. Foundation drainage systems
      2. Underdrains
   B. Related Sections:
      1. Section 01400 - Quality Control
      2. Section 02200 - Earthwork

1.2 SUBMITTALS:
   A. Certification:
      1. Submit 2 copies of certification signed by Contractor and foundation drainage system
         Installer indicating that installed materials conform to specified requirements and
         system was successfully checked and tested prior to covering.

PART 2 - PRODUCTS
2.1 MATERIALS:
   A. Pipe: PVC, perforated or plain, complying with ASTM D2729. Envelope pipe in
      continuous filter fabric sock.
   B. Drainage Fill: Placed to a minimum depth of 4" below pipe. Provide gradation
      recommended by the Soils Engineer.
   C. Filter Fabric: Mirafi 140N or approved substitute polypropylene fabric weighing not less
      than 4 oz. per sq. yd. for wrapping of drainage fill.
   D. Other Materials: As required by detailing and Soils Engineer's recommendations.

PART 3 - EXECUTION
3.1 BACKFILLING:
   A. Do not backfill any foundation drainage systems until inspected by the Owner.

3.2 FIELD QUALITY CONTROL:
   A. Testing Drain Lines: Test or check lines before backfilling to assure free flow. Remove
      obstructions, replace damaged components, and retest system until satisfactory.
END OF SECTION 02711
SECTION 02810
IRRIGATION SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED - Work of this Section generally includes provisions for the installation of an underground irrigation system including the following:

A. Static pressure verification and coordination of irrigation system installation with landscape material installation.

B. Trenching, stockpiling excavation materials, refilling and compacting trenches.

C. Complete irrigation system including but not limited to piping, valves, fittings, heads, controllers and wiring, and final adjustments to insure complete coverage.

D. Water connections.

E. Replacement of unsatisfactory materials.

F. Clean-up, inspections, and approval.

G. Tests.

1.2 RELATED SECTIONS

A. Examine all sections related to project work.

1.3 REFERENCES

A. Perform Work in accordance with requirements of Conditions of the Contract and Division 01 - General requirements as well as provisions of all applicable laws, codes, ordinances, rules, and regulations.

B. Conform to requirements of reference information listed below except where more stringent requirements are shown or specified in Contract Documents.

1. American Society for Testing and Materials (ASTM) - Specifications and Test Methods specifically referenced in this Section.

2. Underwriters Laboratories (UL) - UL Wires and Cables.

1.4 QUALITY ASSURANCE

A. Installer Qualifications - Installer shall have had considerable experience and demonstrate ability in the installation of irrigation system(s) of specific type(s) in a neat orderly, and responsible manner in accordance with recognized standards of workmanship. To demonstrate ability and experience necessary for this Project, and financial stability, submit if requested by Consultant, prior to contract award the
following:

1. List of 3 projects completed in the last 2 years of similar complexity to this Project. Description of projects shall include:
   a. Name of project.
   b. Location.
   c. Owner.
   d. Brief description of work and project budget.

2. Current company financial statement.

B. Special Requirements:

1. Work involving substantial plumbing for installation of copper piping, backflow preventer(s), and related Work shall be executed by licensed and bonded plumber(s). Secure a permit at least 48 hours prior to start of installation.

2. Tolerances - Specified depths of mains and laterals and pitch of pipes are minimums. Settlement of trenches is cause for removal of finish grade treatment, refilling, compaction, and repair of finish grade treatment.

3. Coordination With Other Contractors - Protect, maintain, and coordinate Work with Work under other Section.

4. Damage To Other Improvements - Contractor shall replace or repair damage to grading, soil preparation, seeding, sodding, or planting done under other Sections during Work associated with installation of irrigation system at no additional cost to Owner.

C. Pre-Construction Conference - Contractor shall schedule and conduct a conference to review in detail quality control and construction requirements for equipment, materials, and systems used to perform the Work. Conference shall be scheduled not less than 10 days prior to commencement of Work. All parties required to be in attendance shall be notified no later than 7 days prior to date of conference. Contractor shall notify qualified representatives of each party concerned with that portion of Work to attend conference, including but not limited to Architect, Consultant, Contractor's Superintendent, and Installer.

   1. Minutes of conference shall be recorded and distributed by Contractor to all parties in attendance within five days of conference.

1.5 SUBMITTALS - Prepare and make submittals in accordance with conditions of the Contract.

A. Shop Drawings - Submit Shop Drawings if noted on construction drawings, include a complete materials list indicating manufacturer, model number, and description of all materials and equipment to be used. Show appropriate dimensions and adequate detail to accurately portray intent of construction.

B. Record Drawings (As-Builts):

   1. At onset of irrigation installation secure mylar sepias of original irrigation design from Owner. At the end of every day, revise prints for Work
accomplished that day in red ink. As-built sepias shall be brought up-to-date at the close of the working day every Friday by a qualified draftsperson. A print of record plan(s) shall be available at Project Site. Indicate zoning changes on weekly as-built drawings. Indicate non-pressure piping changes on as-builts. Upon completion of Project, submit for review, prior to final acceptance, final set of as-built mylar sepias. Dimensions, from two permanent points of reference (building corners, sidewalk, road intersections or permanent structures), location of following items:

2. 
   a. Connection to existing water lines.
   b. Routing of sprinkler pressure lines (dimension maximum 100 feet along routing).
   c. Sprinkler control valves.
   d. Quick coupling valves.
   e. Drain valves.
   f. Control wire routing if not with pressure mainline.
   g. All gate valves.
   h. Other related equipment as directed.

3. Owners Representative will not certify any pay request submitted by the Contractor if the as-built drawings are not current, and processing of pay request will not occur until as-builts are up-dated.

C. Operation Instructions - Submit 3 written operating instructions including winterization procedures and start-up, with cut sheets of products, and coordinate controller/watering operation instruction with Owner maintenance personnel.

1. Controller Charts:
   a. Do not prepare charts until record (as-built) drawings have been reviewed by Consultant.
   b. Provide one controller chart for each automatic controller installed.
      1) Chart may be reproduction of record drawing, if scale permits fitting of controller door. If photo reduction prints are required, keep reduction to maximum size possible to retain full legibility.
      2) Chart shall be blueline print of actual "as-built" system, showing area covered by that controller.
   c. Identify area of coverage of each remote control valve, using a distinctly different pastel color drawing over entire area of coverage.
   d. Following review of charts by Consultant, they shall be hermetically sealed between two layers of 20 mm thick plastic sheet.
   e. Charts shall be completed and reviewed prior to final review of irrigation system.

1.6 DELIVERY, STORAGE, AND HANDLING - Deliver, unload, store, and handle materials, packaging, bundling, products in dry, weatherproof, condition in manner to prevent damage, breakage, deterioration, intrusion, ignition, and vandalism. Deliver in original unopened packaging containers prominently displaying manufacturer's name, volume, quantity, contents,
instructions, and conformance to local, state, and federal law. Remove and replace cracked, broken, or contaminated items or elements prematurely exposed to moisture, inclement weather, snow, ice, temperature extremes, fire, or jobsite damage.

A. Handling of PVC Pipe - Exercise care in handling, loading and storing, of PVC pipe. All PVC pipe shall be transported in a vehicle which allows length of pipe to lie flat so as not to subject it to undue bending or concentrated external loads. All sections of pipe that have been dented or damaged shall be discarded, and if installed, shall be replaced with new piping.

1.7 JOBSITE CONDITIONS:

A. Protection of Property:

1. Preserve and protect all trees, plants, monuments, structures, and paved areas from damage due to Work of this Section. In the event damage does occur, all damage to inanimate items shall be completely repaired or replaced to satisfaction of Owner, and all injury to living plants shall be repaired by Owner. All costs of such repairs shall be charged to and paid by Contractor.

2. Protect buildings, walks, walls, and other property from damage. Flare and barricade open ditches. Damage caused to asphalt, concrete, or other building material surfaces shall be repaired or replaced at no cost to Owner. Restore disturbed areas to original condition.

B. Existing Trees:

1. All trenching or other Work under limb spread (dripline) of any and all evergreens or deciduous material shall be done by hand or by other methods so as to prevent damage to root system.

2. Prune any branches of trees to be preserved which may be damaged by construction.

3. Where it is necessary to excavate adjacent to existing trees use all possible care to avoid injury to trees and tree roots. Excavation, in areas where 2 inch and larger roots occur, shall be done by hand. Roots 2 inches or larger in diameter, except directly in the path of pipe of conduit, shall be tunneled under and shall be heavily wrapped with burlap to prevent scarring or excessive drying. Where a trenching machine is operated close to trees having roots smaller than 2 inches in diameter, wall of trench adjacent to tree shall be hand trimmed, making clean cuts through roots. Trenches adjacent to trees shall be closed within 24 hours, and when this is not possible, side of trench adjacent to tree shall be kept shaded with moistened burlap or canvas.

C. Protection and Repair of Underground Lines:

1. Request proper utility company to stake exact location (including depth) of all underground electric, gas, or telephone lines. Take whatever precautions are necessary to protect these underground line from damage. If damage does occur, all damage shall be repaired by Utility Owner. All costs of such repairs shall be paid by Contractor unless other arrangements have been made.
2. Request Owner, in writing, to locate all private utilities (i.e., electrical service to outside lighting) before proceeding with excavation. If, after such request and necessary staking, private utilities which were not staked are encountered and damaged by Installer, they shall be repaired by Owner at no cost to Installer. If Contractor damages staked or located utilities, they shall be repaired by Utility Owner at Contractor's expense unless other arrangements have been made.

D. Replacement of Paving and Curbs - Where trenches and lines cross existing roadways, paths, curbing, etc., damage to these shall be kept to a minimum and shall be restored to original condition.

1.8 WARRANTY/GUARANTY: - Manufacturer shall warrant materials against defects for a period of one year from date of Substantial Completion. Installer(s) shall guaranty workmanship for similar period.

A. Settling of backfilled trenches which may occur during guaranty period shall be repaired at no expense to Owner, including complete restoration of damaged property.

B. Expenses due to vandalism before substantial completion shall be borne by Contractor.

C. Owner will maintain turf and planting areas during warranty period, so as not to hamper proper operation of irrigation system.

1.9 MAINTENANCE:

A. Winterization - include cost in bid for winterizing complete system at conclusion of sprinkling season (in which system received final acceptance) within 3 days notification by the Owner. System shall be voided of water using compressed air or similar method reviewed by Consultant. Reopen, operate, and adjust system malfunctions accordingly during April of following season within 3 days of notification by Owner.

1.10 EXTRA STOCK - In addition to installed system furnish the following items to Owner:

A. 10 Pop-up spray heads with nozzles of each type used.

B. 4 Rotor heads of each type used.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. General Piping:

1. Pressure Supply Lines (Downstream Of Backflow Prevention Units) – **Schedule 40 PVC For All Sizes Available In Schedule 40 PVC.**
2. Non-Pressure Lines And Lateral Lines Schedule 40 PVC

B. Copper Pipe and Fittings:
   1. Copper Pipe - Type K, hard tempered.
   2. Fittings - Wrought copper, solder joint type.
   3. Joints - Soldered with solder, 45% silver, 15% copper, 16% zinc, and 24% cadmium and solidus at 1125°F and liquids at 1145°F.

C. Copper Pipe and Brass Pipe and Fittings:
   1. Brass Pipe - 85% red brass, ANSI Schedule 40 screwed pipe.
   2. Fittings - Medium brass, screwed 125 pound class.

D. Plastic Pipe and Fittings:
   1. Identification Markings:
      a. Identify all pipe with following indelible markings:
         1) Manufacturer's name.
         2) Nominal pipe size.
         3) Schedule of class.
         4) Pressure rating.
         5) NSF (National Sanitation Foundation) seal of approval.
         6) Date of extrusion.
   2. Solvent Weld Pipe - Manufactured from virgin polyvinyl chloride (PVC) compound in accordance with ASTM D2241 and ASTM D1784; cell classification 12454-B, Type 1, Grade 1.
      a. Fittings - Standard wright, Schedule 40, injection molder PVC; complying with ASTM D1784 and D2466, cell classification 12454-B.
         1) Threads - Injection molded type (where required).
         2) Tees and ells - Side gated.
      b. Threaded Nipples - ASTM D2464, Schedule 80 with molded threads.
      c. Joint Cement and Primer - Type as recommended by manufacturer of pipe and fittings.
   3. Gasketed End Pipe - Manufactured from virgin Polyvinyl Chloride compound in accordance with ASTM D2241 and ASTM D1784; cell classification 1254-B, Type 1, Grade 1.
      a. Fittings (3" and larger) - Ductile iron, grade 70-55-05 in accordance with ASTM A-536. Fittings shall have deep bell push-on joints with gaskets meeting ASTM F-477.
      b. Gaskets - Factory installed in pipe and fittings, having a metal or plastic support within gasket or a plastic retainer ring for gasket.
      c. Lubricant - As recommended by manufacturer of pipe fittings.

E. Gate Valves:
   1. Gate Valves For ¾ Inch Through 1-1/2 Inch Pipe – Brass Construction; Solid Wedge, IPS Threads, And Non-Rising Stem With Wheel Operating Handle.
2. Gate Valves For 2 Inch And Larger Pipe – Iron Body, Brass Or Bronze Mounted AWWA Gate Valves With A Clear Waterway Equal To Full Nominal Diameter Of Valve; Rubber Gasket, Threaded, Or Mechanical Joint Types Only. Valves Shall Be Able To Withstand A Continuous Working Pressure Of 200 PSI And Be Equipped With A Square Operating Nut And Resilient Wedge. Provide Pipe Restraints On Gate Valves 3 Inches Or Larger As Detailed.

F. Quick Coupling Valves - Brass two-piece body designed for working pressure of 150 PSI; operable with quick coupler. Equip quick coupler with locking rubber cover. Key size and type as shown on Drawing.

G. Valve Boxes:
   1. Gate Valves, Drip Line Blow-out Stubs, and Wire Stub Box - Carson #910-12, Brooks #1100, box as detailed.
   2. 3/4 inch through 2 inch Control Valves - Carson #1419-13B, Brooks #1419 box.
   3. Drip Valve Assemblies - Carson #1320-13B as detailed.

H. Electrical Control Wiring:
   1. Low Voltage:
      a. Electrical Control Wire - AWG UFUL approved No. 14 direct burial copper wire or larger, if required to operate system as designed.
      b. Wire Colors:
         1) Control Wires - Red.
         2) Common Wires - White.
         3) Master Valve Wires - Blue.
         4) Spare Control Wires - Black.
         5) Spare Common Wires - Yellow.
      c. If multiple controllers are utilized, and wire paths of different controllers cross each other, both common and control wires from each controller shall be different colors approved by Consultant.
      d. Control Wire connections and splices shall be made with 3M direct bury splice, Rain Bird Pentite connectors, or similar dry splice method.
      e. If The Splice Is Too Be Made With A Round Box Over It For Access Control Wire Connections And Splices Shall Be Made With 3M DBY Direct Bury Splice, Rain Bird Pentite Connectors, Or Similar Dry Splice Method. If No Round Box Will Be Used The Joints Must Be Twisted In An In-Line Fashion, Soldered, And A Shrink Tube Is To Be Heated Around The Joint To Prevent Any Penetration From Water Or Elements.
   2. High Voltage - Type required by local codes and ordinances, of proper size to accommodate needs of equipment serviced.
I. **Ball Valves, Electric Control Valves, And Unions:**

1. **Ball Valves** - A Ball Valve Should Be Placed In Each Box Containing A Valve And Is To Be Run In-Line After The Tap Off The Main Line And Before Electric Control Valve. All Ball Valves Used Are To Be Asahi Valve Threaded Ball Valves, Sch 40 And Rated At 150 PSI At 70F, Sized According To Print.


3. **Unions** - Each Valve Installed Should Be Followed By A Threaded Union On The Lateral Side To Work With Threaded 90 At The Top Of The T Off Of Main Line For Maintenance. Unions Shall Be Made By Dura Plastic Products And Be FIPT x FIPT Sch 40 And Be Rated At 150 PSI at 73F, Sized According To Print.

J. **Automatic Controller** - Size and type shown on Drawings; mounted as detailed.

K. **Electric Control Valves** - Size and type shown on Drawings having manual flow adjustment (except drip valves) and manual bleed nut.

L. **Sprinkler Heads** - As indicated on Drawings. Fabricated riser units in accordance with details on Drawings - with riser nipples of same size as riser opening in sprinkler body.

M. **Backflow Preventer** - Existing.

PART 3 - EXECUTION

3.1 **LANDSCAPE PLAN REVIEW AND COORDINATION** - Contractor will be held responsible for coordination between landscape and irrigation system installation. Landscape material locations shown on the Landscape Plan shall take precedence over the irrigation system equipment locations. If irrigation equipment is installed in conflict with the landscape material locations shown on the Landscape Plan, the Contractor will be required to relocate the irrigation equipment, as necessary, at Contractor's expense.

3.2 **STATIC PRESSURE VERIFICATION** - Contractor shall field verify the static pressure at the project site, prior to commencing work or ordering irrigation materials, and submit findings, in writing, to Consultant. If Contractor fails to verify static water pressure prior to commencing work or ordering irrigation materials, Contractor shall assume responsibility for all costs required to make system operational and the costs required to replace any damaged landscape material. Damage shall include all required material costs, design costs and plant replacement costs.

3.3 **INSPECTION:** - Examine areas and conditions under which Work of this Section is to be performed. Do not proceed with Work until unsatisfactory conditions have been corrected.
A. Grading operations, with the exception of final grading, shall be completed and approved by Owner before staking or installation of any irrigation system begins.

3.4 PREPARATION:

A. Staking shall Occur as Follows:

1. Mark, with powdered lime, routing of pressure supply line and flag heads for first few zones. Contact Consultant 48 hours in advance and request review of staking. Consultant will advise installer as to the amount of staking to be prepared. Consultant will review staking and direct changes if required. Review does not relieve installer from coverage problems due to improper placement of heads after staking.

2. If Project has significant topography, freeform planting beds, or other amenities which could require alteration of irrigation equipment layout as deemed necessary by Consultant, do not install irrigation equipment in these areas until Consultant has reviewed equipment staking.

B. Install sleeving under asphalt paving and concrete walks, prior to concreting and paving operations, to accommodate piping and wiring. Compact backfill around sleeves to 95% Modified Proctor Density within 2% of optimum moisture content in accordance with STM D1557.

C. Trenching - Trench excavation shall follow, as much as possible, layout shown on Drawing. Dig trenches straight and support pipe continuously on bottom of trench. Trench bottom shall be clean and smooth with all rock and organic debris removed.

1. Clearances:
   a. Piping 3 Inches and Larger - Make trenches of sufficient width (14 inches minimum) to properly assemble and position pipe in trench. Minimum clearance of piping 3 inches or larger shall be 5 inches horizontally on both sides of the trench.
   b. Piping Smaller than 3 Inches - Trenches shall have a minimum width of 7 inches.
   c. Line Clearance - Provide not less than 6 inches of clearance between each line, and not less than 12 inches of clearance between lines of other trades.

2. Pipe and Wire Depth:
   a. Pressure Supply Piping - 24 inches from top of pipe.
   b. PVC Sleeving - 18 inches from top of pipe.
   c. Non-pressure Piping (rotor) - 18 inches from top of pipe.
   d. Non-pressure Piping (pop-up) - 12 inches from top of pipe.
   e. Control Wiring - Side of pressure main.
   f. Drip Tubing - 12 inches from top of pipe.
   g. Emitter Tubing (Micro-tubing) - 8 inches from top of pipe.

3. Boring will be permitted only where pipe must pass under obstruction(s) which cannot be removed. In backfilling bore, final density of backfill shall match that of surrounding soil. It is acceptable to use sleeves of suitable diameter installed.
first by jacking or boring, and pipe laid through sleeves. Observe same precautions as though pipe were installed in open trench.

3.5 INSTALLATION - Locate other equipment as near as possible to locations designated. Deviations shall be reviewed by Consultant prior to installation.

A. PVC Piping - Snake pipe in trench as much as possible to allow for expansion and contraction. Do not install pipe when air temperature is below 40°F. Place manual drain valves at low points and dead ends of pressure supply piping to insure complete drainage of system. When pipe laying is not in progress, or at end of each day, close pipe ends with tight plug or cap. Perform Work in accordance with good practices prevailing in piping trades.

1. Solvent Weld PVC Pipe - Lay pipe and make all plastic to plastic joints in accordance with manufacturer's recommendations.

2. Gasketed End Pipes:
   a. Lay pipe and make pipe to fitting or pipe to pipe joint, following OR70 recommendations (Johns-Manville Guide for Installation of Ring-Tite Pipe), or pipe manufacturer's recommendations.
   b. Construct thrust blocks behind all gasketed fittings, tees, bends, reducers, line valves, and caps in accordance with pipe manufacturer's recommendations. Contact Consultant prior to placing thrust blocks, for observation of thrust block excavation and initial placement. Size thrust blocks based on tables below:

THRUST BLOCK SIZING GUIDE:
Thrust developed per 100 PSI pressure (lbs. force) for various fitting configurations.

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Fitting 90 deg. Elbow</th>
<th>Fitting 45 deg. Elbow</th>
<th>Valves, Tees Dead Ends</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1,000</td>
<td>600</td>
<td>800</td>
</tr>
<tr>
<td>4</td>
<td>1,800</td>
<td>1,100</td>
<td>1,300</td>
</tr>
</tbody>
</table>

Approximate bearing strength of typical soils.

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Lbs/ft 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mulch, Peat, etc.</td>
<td>0</td>
</tr>
<tr>
<td>Soft Clay</td>
<td>500</td>
</tr>
<tr>
<td>Sand</td>
<td>1,000</td>
</tr>
<tr>
<td>Sand and Gravel</td>
<td>1,500</td>
</tr>
<tr>
<td>Sand and Gravel with Clay</td>
<td>2,000</td>
</tr>
<tr>
<td>Sand and Gravel Cemented with Clay</td>
<td>4,000</td>
</tr>
<tr>
<td>Hard Pan</td>
<td>5,000</td>
</tr>
</tbody>
</table>

B. Control Wiring:

1. Low Voltage Wiring:
a. Bury control wiring between controller and electric valves in pressure supply line trenches, strung as close as possible to main pipe lines with such wires to be consistently located below and to one side of pipe, or in separate trenches.

b. Bundle all 24 volt wires at 10 foot intervals and lay with pressure supply line pipe to one side of the trench.

c. Provide an expansion loop at every pressure pipe angle fitting, every electric control valve location (in valve box), and every 500 feet. Form expansion loop by wrapping wire at least 8 times around a 3/4 inch pipe and withdrawing pipe.

d. Make all splices and E.C.V. connections using Rain Bird Pentite connectors or similar dry splice method.

e. Install all control wire splices not occurring at control valve in a separate splice valve box.

f. Install one control wire for each control valve.

g. Run two spare #14 AWG UFUL control wires and one common wire from controller pedestal to the end of each and every leg of mainline. Label spare wires at controller and wire stub box.

2. High Voltage Wiring for Automatic Controller:

   a. Provide 120 volt power connection to automatic controller.

   b. All electric work shall conform to local codes, ordinances, and authorities having jurisdiction. All high voltage electrical work shall be performed by licensed electrician.

C. Automatic Controller:

   1. Install controller in accordance with manufacturer's instructions as detailed and where shown on Drawings.

   2. Connect remote control valves to controller in numerical sequence as shown on Drawings.

   3. Final location of controller shall be approved by Consultant prior to installation.

   4. Each controller shall be a dedicated separate ground wire and grounding rod as detailed.

   5. All above ground conduit shall be rigid galvanized with appropriate fittings. All below ground conduit shall be schedule 40 PVC.

D. Electric Control Valves - Install cross-handle 3 inches below finished grade where shown on Drawings as detailed. When grouped together, allow at least 12 inches between valve box sides. Install each remote control valve in a separate valve box. Install individual valve box flush with grade.
E. Quick Coupling Valves - Install quick couplers on double swing-joint assemblies of Schedule 80 PVC pipe; plumb and flush to grade. Angled nipple relative to pressure supply line shall be no more than 45 degrees and no less than 10 degrees. Install quick coupling valves as detailed.

F. Drain Valves - Install manual drain valves at all low points in pressure supply line as detailed. Provide a three cubic foot drainage sump for each drain valve installed.

G. Valve Boxes:
   1. Install one valve box for each type of valve installed as detailed. Valve box extensions are not acceptable except for master valves. Install gravel sump after compaction of all trenches. Place final portion of gravel inside valve box after valve box is backfilled and compacted.
   2. Brand controller letter and station number on lid of each valve box. Letter and number size shall be no smaller than 1 inch and no greater in size than 1 1/2 inches. Depth of branding shall be no more than 1/8 inch into valve box lid.

H. Gate Valves - Install where shown on Drawings as detailed.

I. Sprinkler Heads - Install sprinkler heads where designated on Drawings or where staked. Set to finish as detailed. Spacing of heads shall not exceed the maximum indicated on Drawing unless re-staked as directed by Consultant. In no case shall the spacing exceed maximum recommended by manufacturer. Install heads on double swing-joint risers of schedule 40 PVC pipe. Angled nipple relative to non-pressure line shall be no more than 45 degrees or less than 10 degrees. Adjust part circle heads for proper coverage. Adjust heads to correct height after sod is installed. Plant placement shall not interfere with intended sprinkler head coverage, piping, or other equipment. Consultant may request nozzle changes or adjustments without additional cost to the Owner.

J. Backflow Preventer - Existing.

K. Backfilling - Do not begin backfilling operations until required system tests have been completed. Backfill shall not be done in freezing weather except with review by Consultant. Leave trenches slightly mounded to allow for settlement after backfilling is completed. Trenches shall be finish graded prior to walk-through of system by Consultant.
   1. Materials - Excavated material is generally considered satisfactory for backfill purposes. Backfill material shall be free of rubbish, vegetable matter, frozen materials, and stones larger than 1 inch in maximum dimension. Do not mix subsoil with topsoil. Material not suitable for backfill shall be hauled away. Contractor shall be responsible for providing suitable backfill if excavated material is unacceptable or not sufficient to meet backfill, compaction, and final grade requirements.
   2. Do not leave trenches open for a period of more than 48 hours. Open
excavations shall be protected in accordance with OSHA regulations.

3. Compact backfill to 90% maximum density, determined in accordance with ASTM D155-7 utilizing the following methods:
   a. Mechanical tamping.
   b. Puddling or ponding. Puddling or ponding and/or jetting is prohibited within 20'-0" of building or foundation walls.

L. Piping Under Paving:

1. Provide for a minimum cover of 18 inches between the top of the pipe and the bottom of the aggregate base for all pressure and non-pressure piping installed under asphaltic concrete or concrete paving.
2. Piping located under areas where asphalt or concrete paving will be installed shall be bedded with sand (a layer 6" below pipe and 6" above pipe).
3. Compact backfill material in 6" lifts at 90% maximum density determined in accordance with ASTM D155-7 using manual or mechanical tamping devices.
4. Set in place, cap, and pressure test all piping under paving, in presence of Owner prior to backfilling and paving operations.
5. Piping under existing walks or concrete pavement shall be done by jacking, boring, or hydraulic driving, but where cutting or breaking of walks and/or concrete is necessary, it shall be done and replaced at not cost to Owner. Obtain permission to cut or break walks and/or concrete from Owner.

M. Water Supply and Point of Connection - Water supply shall be extended as shown from water supply lines.

3.6 FIELD QUALITY CONTROL:

A. Flushing - After piping, risers, and valves are in place and connected, but prior to installation of sprinkler heads, quick coupler assemblies, and hose valves, thoroughly flush piping system under full head of water pressure from dead end fittings. Maintain flushing for 5 minutes through furthest valves. Cap risers after flushing.

B. Testing - Conduct tests in presence of Consultant. Arrange for presence of Consultant 48 hours in advance of testing. Supply force pump and all other test equipment.

1. After backfilling, and installation of all control valves, fill pressure supply line with water, and pressurize to 40 PSI over the designated static pressure or 120 PSI, whichever is greater, for a period of 2 hours.
2. Leakage, Pressure Loss - Test is acceptable if no loss of pressure is evident during the test period.
3. Leaks - Detect and repair leaks.
4. Retest system until test pressure can be maintained for duration of test.
5. Before final acceptance, pressure supply line shall remain under pressure for a period of 48 hours.

C. Walk-Through for Substantial Completion:

1. Arrange for Consultant's presence 48 hours in advance of walk-through.
2. Entire system shall be completely installed and operational prior to scheduling of walk-through.
3. Operate each zone in its entirety for Consultant at time of walk-through and additionally, open all valve boxes if directed.
4. Generate a list of items to be corrected prior to Final Completion.
5. Furnish all materials and perform all work required to correct all inadequacies of coverage due to deviations from Contract Documents.

D. Walk-Through for Final Completion:

1. Arrange for Consultant's presence 48 hours in advance of walk-through.
2. Show evidence to Consultant that Owner has received all accessories, charts, record drawings, and equipment as required before Final Completion walk-through is scheduled.
3. Operate each zone, in its entirety for Consultant at time of walk-through to insure correction of all incomplete items.
4. Items deemed not acceptable by Consultant shall be reworked to complete satisfaction of Consultant.
5. If after request to Consultant for walk-through for Final Completion of irrigation system, Consultant finds items during walk-through which have not been properly adjusted, reworked, or replaced as indicated on list of incompleted items from previous walk-through, Contractor shall be charged for all subsequent walk-throughs. Funds will be withheld from final payment and/or retainage to Contractor, in amount equal to additional time and expenses required by Consultant to conduct and document further walk-throughs as deemed necessary to insure compliance with Contract Documents.

3.7 ADJUSTING - Upon completion of installation, "fine-tune" entire system by regulating valves, adjusting patterns and break-up arms, and setting pressure reducing valves at proper and similar pressure to provide optimum and efficient coverage. Flush and adjust all sprinkler heads for optimum performance and to prevent overspray onto walks, roadways, and buildings as much as possible. Heads of same type shall be operating at same pressure +/- 7%.

A. If it is determined that irrigation adjustments will provide proper coverage, and improved water distribution as determined by Consultant, contractor shall make such adjustments prior to Final Acceptance, as directed, at no additional cost to Owner. Adjustments may also include changes in nozzle sizes, degrees of arc, and control valve throttling.

B. All sprinkler heads shall be set perpendicular to finish grade unless otherwise designated.

C. Areas which do not conform to designated operation requirements due to
unauthorized changes or poor installation practices shall be immediately corrected at no additional cost to the Owner.

3.8 CLEANING - Maintain continuous cleaning operation throughout duration of work. Dispose of, off-site at not additional cost to Owner, all trash or debris generated by installation of irrigation system.
IRRIGATION EQUIPMENT SPECIFICATIONS  
EFFECTIVE FEBRUARY 1998

Pop-up Spray Head      Rainbird 1804-SAM-PRS  
Pop-up Spray Nozzle    Rainbird 1800 Brass Nozzle  
Shrub Spray Head       Rainbird 1812-SAM-PRS  
Gear Driven Rotor      Hunter I-25-ADS (35 to 45 feet)  
                        Hunter I-40 (Greater than 45 feet)  
Control Valve          Irritol 700 Series  
Controller             Toro Network 8000 Satellite  
                        Model 132-76-08  
Quick Coupler Valve    Rainbird 44NP  
Control Valve Boxes    Carson #1419-13B  
Gate Valve Boxes       Carson #910-12  
Wire Splice Boxes      Carson #910-12  
Drip Valve Boxes       Carson #1320-13B  
Communication Cable    Paige P7162DA  

No substitutions will be allowed for the above equipment and all equipment shall be installed according to detail sheets.

END OF SECTION 02810
SECTION 02870
SITE AND STREET FURNISHINGS

PART 1 - GENERAL

1.1 SUMMARY:

A. Section Includes:

1. Site and street furnishings including the following:
   a. Trash and recycling receptacles.
   b. Ash receptacles.
   c. Tree grates.
   d. Bike racks.
   e. Benches
   f. Tables
   g. Bollards
   h. Recycle Receptacles

1.2 QUALITY ASSURANCE:

A. General:

1. Provide each type of site furnishing from one source and from a single manufacturer unless directed or specified otherwise.

2. Listed selections have been made to provide a uniform appearance across the main campus. Designer may request variation from UCB staff. Selections apply only to main campus and portions of other campuses. Specific design guidelines apply to Williams Village and the Research Park. Contact Facilities Planning for specific information.

PART 2 - PRODUCTS

2.1 FURNISHINGS:

A. Trash Receptacles: SD-42, 36 gallon, capacity, side opening and lockable, trash receptacle by Victor Stanley, Dunkirk, MD 1-800-368-2573. www.victorstanley.com


F. Tables: Landscapeforms Carousel Table with 3,4,5 or 6 seats. Seats are backed or backless. Table top is steelhead perforated with umbrella hole. Seats are perforated metal surface mount. Landscapeforms, Kalamazoo, MI, 1-800-521-2546, www.landscapeforms.com

G. Landscape Forms Gretchen picnic table with recycled plastic top, 54” length shall be an optional choice for tables.


H. Recycling Receptacles: SD-42, 36 gallon capacity trash receptacle, side opening and lockable, coupled with SD-42 can labeled NEWSPAPER, with a restrictive opening and a SD-42 can labeled CO-MINGLED CONTAINERS with a restrictive opening. Three can stations shall be placed within a few feet of each other and not separated. Victor Stanley, Inc., Dunkirk, MD, 1-800-368-2573, www.victorstanley.com

I. Specify black for all site furniture unless otherwise noted or approved.

J. Exterior Shade Structures: Classic Recreation Systems, Mesa Model, modified single, post, black. Refer to www.classicrecreation.com

PART 3 - EXECUTION

3.1 INSTALLATION:

A. General:

1. Show all items accurately located on drawings.
2. Obtain field verification of location for each item from Architect and Owner before proceeding.
3. Set units plumb, level, and free of warp or racking.
4. Install as recommended by the manufacturer, including anchorage devices.

END OF SECTION 02870
SECTION 02900
LANDSCAPING, GENERAL

PART 1 - GENERAL

1.1 SUMMARY:

A. Section includes:
   1. Landscaping general requirements.
   2. Landscaping accessories.

B. Related Sections:
   1. Section 02111 – Tree and Plant Protection
   2. Section 02810 - Irrigation System.
   3. Section 02920 - Soil Preparation.
   4. Section 02930 - Lawns and Grasses.
   5. Section 02931 – Native Grasses Seeding
   6. Section 02932 – Bluegrass Sodding
   7. Section 02950 - Trees, Plants and Ground Covers.

1.2 REFERENCES:

A. Uniform Federal Accessibility Standards (UFAS).

B. University of Colorado, Boulder Campus Office of Facilities Planning:
   1. Campus Master Plan.
   2. Campus District Micro Master Plans (when applicable).
   3. Williams Village Master Site Development Plan and Design Guidelines (when applicable).
   4. Research Park Master Site Development Plan and Design Guidelines (when applicable).

1.3 DEFINITIONS:

A. The terms listed below have been used in this section and throughout the UCB Standards. Definitions are provided for each.
   1. Landscape: Every single item on the campus floor except buildings occupied by people, materials storage, or equipment.
   2. Operations: The series of actions taken to establish procedures and various controls that keep the campus functioning a high level of efficiency. These Include: Planning, scheduling, budgeting, coordinating, supervising, improving, and maintaining the campus landscape.
   3. Maintenance: The constant and continuing upkeep of campus facilities and plant material.
   4. Development: The physical evolvement of the campus landscape through the
enhancement of existing facilities and the creation of new facilities where none existed before.

5. Facilities: The physical objects that are built, installed, or established that serve a particular purpose in the campus landscape, such as buildings, walks, streets, parking lots, benches, lighting, and all other man-made items in the campus landscape -- but not plant material.


1.4 SUBMITTALS:

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Materials List:

1. Plant material including source and location.
2. Mulches, organic rocks.
3. Amendments.
4. Accessories including edging, stake-guy system.

C. Plant and Material Certifications:

1. Certificates of inspection as required by government authorities.
2. Manufacturer’s or vendor’s certified analysis for soil amendments and fertilizer materials.
3. Label data substantiating that plants, trees, shrubs and planting materials comply with specified requirements.
4. Seed vendor’s certified statement for each grass seed mixture required. Stating botanical and common name, percentages by weight, and percentages of purity, germination, and weed seed for each grass seed species.

D. Planting Schedule: Proposed planting schedule, indicating dates for each type of landscape work during normal seasons for such work in area of site. Correlate with specified maintenance periods to provide maintenance from date of substantial completion. Once accepted, revise dates only as approved in writing, after documentation of reason for delays.

E. Maintenance Instructions: Typewritten instructions recommending procedures to be established by Owner for maintenance of landscape work for one full year. Submit prior to expiration of required maintenance period(s).

1.5 QUALITY ASSURANCE:

A. Pre-Planting Inspection:

1. The Owner and Landscape Consultant will inspect all trees at the nursery before planting commences.
2. All plant fertilizers, backfill mixes, mulches and soil amendments will be accepted by
the Owner prior to planting operations.

B. Planting Inspections:

1. The Owner or Landscape Consultant will inspect the staked location of all trees prior to planting.
2. The Owner or Landscape Consultant will inspect the staked locations of container stock prior to planting. Contractor to report any variance of quantity on unit price contracts.

C. Pre-Maintenance Inspection:

1. The Owner or Landscape Consultant will inspect site at the completion of all planting operations.

D. Final Inspection:

1. Final acceptance of the Owner and Landscape Consultant will not be given until all deficiencies are corrected.

1.6 DELIVERY, STORAGE AND HANDLING

A. Packaged Material: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery, and while stored at site.

1.7 JOB CONDITIONS

A. Utilities: Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others 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.

PART 2 - MATERIALS

2.1 TOPSOIL

A. Topsoil for landscape work may not be available at site and must be furnished and as specified.

B. Provide new topsoil that is fertile, friable, natural loam, surface soil, reasonably free of subsoil, clay lumps, brush, weeds and other litter, and free of roots, stumps, stones larger than 2 inches in any direction, and other extraneous or toxic matter harmful to plant growth.

1. Obtain topsoil from local sources or from areas having similar soil characteristics to
that found at project site. Obtain topsoil only from naturally well-drained sites where topsoil occurs in depth of no less than 4 inches. Do not obtain from bogs or marshes.

2.2 SOIL AMENDMENTS AND FERTILIZERS:

A. Type, analysis and application shall be determined by the Landscape Consultant based upon type of planting and the results of specific project soil analysis.

B. Submit specific product analysis for approval.

C. Organic Compost: Composted Cow Manure at 4 cubic yards per 1000 square feet.

D. Compost: A-1 Premium 3 Organic Compost

E. Mulch: Organic mulch free from deleterious materials and suitable for top dressing of trees, shrubs, or plants.

2.3 LANDSCAPE MATERIALS:

A. Bark Mulch:
   1. Western Red Cedar Mulch

B. Gravel Mulch:
   1. 3/4" crushed mountain rock, color: Wyoming Red.
   2. Submit sample for acceptance. Depth shall be 3” minimum.

C. Soil Separator Fabric:
   1. 4 oz. per square yard polypropylene fabric, water permeable, and unaffected by U.V. light, freezing and thawing.
   2. Approved substitute fabrics.
   3. Provide at all barking beds and gravel beds.

D. Pre-Emergent Herbicide:
   1. Apply beneath all mulch layers and soil separator fabric. Apply at manufacturer's specified rate. Comply with EPA requirements regarding application and use of product.
   2. Submit manufacturer's data for approval.

E. Landscape Edging
2. Install per manufacturer’s instructions.

F. Crusher Fines: The following type, size, and color. Applied over specified filtration fabric.
   1. Size ¼” minus
   2. Color: Wyoming Red (or approved equal)
   3. Applied to 3” depth

G. Anti-Desiccant: Emulsion type, film-forming agent designed to permit transpiration, but retard excessive loss of moisture from plants. Deliver in manufacturer’s fully identified containers and mix in accordance with manufacturer’s instructions.

H. Wrapping: tree-wrap tape not less than 4 inches wide, designed to prevent borer damage and winter freezing.


PART 3 - EXECUTION

3.1 PREPARATION:

   A. Lay out individual tree and shrub locations and areas for multiple plantings, Stake locations and outline areas and secure Architect’s acceptance before start work. Make minor adjustments as may be required.

   B. After receiving approval of staked locations, and prior to digging, the Contractor shall request and verify locations of all utilities within the planting area.

END OF SECTION 02900
SECTION 02920
SOIL PREPARATION

PART I - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Ripping
   2. Fertilizer
   3. Soil Conditioner
   4. Fine Grading

B. Related Sections:
   1. SECTION 02815 - Irrigation Systems
   2. SECTION 02932 – Bluegrass Sodding
   3. SECTION 02931 – Native Grasses Seeding
   4. SECTION 02930 – Bluegrass Seeding

1.2 SUBMITTALS

A. Quality Control Submittals:

   1. Certificates: State, federal and other inspection certificates shall accompany
      invoice for materials showing source or origin. Submit to Owner prior to
      acceptance of material.

1.3 DELIVERY, STORAGE AND HANDLING

A. General: Comply with Section 01600

B. Fertilizer: Deliver inorganic or chemical fertilizer to site in original unopened containers
   bearing manufacturer's guaranteed chemical analysis, name, trade name, trademark and
   conformance to state law, bearing name and warranty of producer.

C. Notify Owner of delivery schedule in advance so material can be inspected upon arrival
   at project site. Immediately remove unacceptable material from project site.

1.4 PROJECT/SITE CONDITIONS

A. General: Do not perform work when climate and existing site conditions will not provide
   satisfactory results.

B. Vehicular accessibility on site shall be as directed by the Landscape Architect. Repair
   damage to prepared ground and surface caused by vehicular movement during work
   under this section to original condition at no additional cost to the Owner. Coordinate
PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Topsoil: Strip, existing 4" of topsoil in all proposed sod areas. Stockpile on-site for future distribution in new sod areas 4" deep.

B. Soil Conditioner: A-1 Premium 3 Organic Compost EKO” compost as provided by Pioneer Sand & Gravel, or equal to be aged organic matter, meeting the following minimum requirements:

1. Minimum Requirements:
   a. Organic matter: 45% minimum.
   b. Salt content: 4.0 mmhos/cm maximum.
   c. pH range: 4.3 - 7.5.

2. Organic material may be:
   a. Aged sawdust or other nitrogen-treated, decomposing wood products
   b. Dried, pulverized poultry manure
   c. Humus
   d. Compost
   e. Aged, treated, pulverized manure
   f. Treated sewage sludge
   g. Other organic material as approved by the Project Manager

3. Aspen humus will not be accepted.

4. Mountain Peat shall not be allowed as a soil improvement.

C. First Application Fertilizer to all landscape areas: Inorganic mixture with the following chemical composition: Before sodding, incorporate 4 lbs. of diammonium phosphate (18-46-0) per 1000 sq. ft. tilled into a depth of 6".

PART 3 - EXECUTION

3.1 EXAMINATION

A. General: Verify that existing site conditions are as specified and indicated before beginning work under this Section.

1. Grades: Inspect to verify rough grading is within +0.1 foot of grades indicated and specified.

2. Damaged Earth: Inspect to verify that earth rendered unfit to receive planting due to concrete, water, mortar, limewater or any other contaminant dumped on it has been removed and replaced with clean earth from a source approved by the Landscape Architect.

B. Unsatisfactory Conditions: Report in writing to General Contractor with copy to Owner.
C. Acceptance: Beginning of installation means acceptance of existing conditions by installer.

3.2 PREPARATION

A. Protection:
   1. Contractor shall locate sewer, water, irrigation, gas, electric, phone and other pipelines, conduits or utilities and equipment prior to commencing work.
   2. Contractor shall be responsible for proper repair to landscape, utilities, walls, pavements and other existing site improvements damaged by operations under this section.

B. Weed Control: Remove annual weeds by tilling. Remove perennial weeds by applying herbicide 1 week before soil preparation and as needed, but no sooner than two weeks before soil preparation is to begin.

C. Surface Grade: Remove weeds, debris, clods and rocks larger than 1/2". Dispose of accumulated debris at direction of Landscape Architect.

D. Runoff: Take measures and furnish equipment and labor necessary to control the flow, drainage, and accumulation of water. Insure that all water will run off the grades.

E. Erosion Control: Take measures and furnish equipment and labor necessary to control and prevent soil erosion, blowing soil and accumulation of wind-deposited material on the site throughout duration of work.

3.3 INSTALLATION

A. Soil Amendment:
   1. Evenly distribute aged organic matter, and first application of fertilizer in landscaped areas at the following rates:
      a. Aged organic matter at the rate of 2 3 cu. yds. per 1,000 sq. ft. to sod and seed areas. Aspen humus will not be accepted.
      b. Fertilizer Application:
         1) First application is specified under Section 02920, 2.1 C.
   2. After applying soil conditioner and fertilizer, thoroughly till area to depth of 6" minimum by plowing, harrowing, or diskng until soil is well pulverized and thoroughly mixed.

B. Fine Grading in all Landscape Areas:
   1. Do fine grading for areas prior to planting.
   2. For ground surface areas surrounding buildings to be landscaped, maintain required positive drainage away from buildings.
   3. Establish finish grades to within 0.04 foot of grades indicated.
4. Noxious weeds or parts thereof shall not be present in the surface grade prior to landscaping.
5. Prior to acceptance of grades, hand rake to smooth, even surface free of debris, clods, rocks, and vegetable matter greater than 1/2”.

3.4 NOTIFICATION AND INSPECTION

A. Inspection: Provide notice to Landscape Architect requesting inspection at least 7 days prior to anticipated date of completion.

B. Deficiencies: Landscape Architect will specify deficiencies to Contractor who shall make satisfactory adjustments and shall again notify Landscape Architect for final inspection.

3.5 CLEANING

A. General: Remove debris and excess materials from site. Clean out drainage inlet structures. Clean paved and finished surfaces soiled as a result of work under this Section, in accordance with direction given by Landscape Architect.

3.6 PROTECTION

A. General: Provide and install barriers as required and as directed by Landscape Architect to protect completed areas against damage from pedestrian and vehicular traffic until acceptance by Owner. Contractor is not responsible for malicious destruction caused by Others.

END OF SECTION 02920
SECTION 02932
BLUEGRASS SODDING

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Fertilizer.
   2. Sod.
B. Related Sections:
   1. Section 02815 - Irrigation Systems
   2. Section 02920 - Fine Grading and Soil Preparation

1.2 REFERENCES

1.3 SUBMITTALS
A. Quality Control Submittals:
   1. Certificates: State, Federal and other inspection certificates shall accompany the invoice for materials showing source or origin. Submit to Landscape Architect prior to acceptance of material.
B. Contract Closeout Submittals:
   1. Warranty: At completion of work, furnish written warranty to Owner based upon requirements as specified.

1.4 QUALITY ASSURANCE
A. Source Quality Control:
   1. Sod Materials: Subject to inspection and acceptance. Landscape Architect reserves the right to reject at any time or place prior to acceptance, any work and sod which in the Landscape Architect's opinion fails to meet these specification requirements.
   2. Inspection: Primarily for quality; however, other requirements are not waived even though visual inspection results in acceptance. Notify Landscape Architect of intended sod farm prior to cutting for inspection. Inspection at growth site shall not preclude the right of rejection at project site.
   3. Promptly remove rejected sod from site.
4. Inspection will be made periodically during sodding, at completion and at end of warranty period by Landscape Architect.

B. Sod Standards:

1. General: Healthy, thick turf having undergone a program of regular fertilization, mowing and weed control; free of objectionable weeds; uniform in green color, leaf texture and density; healthy, vigorous root system; inspected and found free of disease, nematodes, pests and pest larvae by the entomologist of the State Department of Agriculture.

2. Each piece of Sod: Sandy-loam soil base that will not break, crumble or tear during sod installation.

3. Thickness: 3/4" thick, excluding top growth and thatch.

4. Thatch: Not to exceed 1/4" uncompressed.

5. Size: Cut in strips 18" wide no more than 24 hours prior to delivery.

1.5 DELIVERY, STORAGE AND HANDLING

A. General: Comply with Section 01600.

B. Sod: Deliver on pallets properly loaded on vehicles and with root system protected from exposure to sun, wind, and heat in accordance with standard practice and labeled with botanical and common name of each grass species in accordance with Federal Seed Act.

1. Protect from dehydration, contamination and heating at all times. Keep stored sod moist and under shade or covered with moistened burlap.

2. Do not drop sod rolls from carts, trucks or pallets.

3. Do not deliver more sod than can be installed within 24 hours.

4. Do not stack sod more than 2 feet deep.

C. Fertilizer: Deliver inorganic or chemical fertilizer to site in original unopened container bearing manufacturer's guaranteed chemical analysis, name, trade name, trademark, warranty and conformance to state law.

1. Material shall be inspected upon arrival at job site.

2. Immediately remove unacceptable material from job site.

1.6 PROJECT/SITE CONDITIONS

A. Existing Conditions:

1. Import and place any fill material required to adjust the fine grade to meet drainage requirements or to match hard surface fine grades.
2. Vehicular accessibility on site shall be as directed by Landscape Architect. Repair damage to prepared grounds and surfaces caused by vehicular movement during work under this section to original condition at no additional cost to Owner.

B. Environmental Requirements:

1. If possible install sod between spring and fall: April 1 - October 1 or anytime irrigation is available daily for one month and once a week for several months (especially for fall/winter sodding).
2. Do not install sod on saturated or frozen soil.

1.7 WARRANTY

A. Sod: Warrant sod for a period of one year from date of Substantial Completion be in a healthy, vigorous growing condition.

1. During the original warranty period, replace at once sod areas that die due to natural causes, etc., or which in Landscape Architect's opinions are unhealthy.
2. Replacement will not be required in any season definitely unfavorable for sodding.
3. Install replacements as originally specified and warranted.

1.8 MAINTENANCE

A. General: The maintenance period shall begin immediately after each area is sodded and continue until final acceptance of entire project. During this time, be responsible for watering, mowing, spraying, weeding, aerating, fertilizing, and all related work as necessary to ensure that sodded areas are in a vigorous growing condition. Furnish all supervision, labor, material and equipment to maintain turf areas.

B. Materials: Conform to specification or otherwise be acceptable to Owner.

C. Watering: Initially water sod upon completion of convenient work areas until installation is complete and the irrigation system can be operated under full control. Water sod sufficiently to moisten subsoil at least 4" deep in a manner not to cause erosion or damage to adjacent finished surfaces. Water shall be free of substances harmful to plant growth. Be responsible for furnishing water from underground sprinkler system, quick couplers or other source.

D. Fertilizing: If work has not received final acceptance within 45 days after initial fertilizer application to sodded areas, repeat fertilizer application to maintain optimal sod vigor.

E. Mowing and Trimming:

1. Mow and Trim around trees (keeping mulch in saucers and beds), walls, fences,
etc., maintaining turf at 2½-2 ¾" height. Do not remove more than 33% of grass leaf in single mowing. Remove grass clippings from pavement areas.

F. Resodding: Resod spots larger than 1 sq. ft. not having healthy, uniform stand of grass.

G. Weed Control: As required, using selective herbicides approved by Owner.

H. Insect and Disease Control: As required, using insecticides and fungicides approved by Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Sod: Colorado grown Kentucky Bluegrass blend having a healthy, vigorous root system. Blend shall contain a minimum of 3 improved varieties. Submit proposed blend to Landscape Architect for review and approval prior to application.

B. Water: Free of substances harmful to plant growth. Be responsible for furnishing water from underground sprinkler system, quick couplers or other source.

C. Fertilizer: Inorganic mixture with following chemical composition:

1. First Application: Under Section 02920, 2.01 C.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General - Verify that existing site conditions are as specified and indicated before beginning work under this section.

1. Layout: Verify layout of sodded areas as indicated prior to starting operations.
2. Grades: Verify that grades are within 0.04 ft. of grades indicated and specified.

B. Unsatisfactory Conditions: Report in writing to General Contractor with copy to Landscape Architect.

C. Beginning of installation means acceptance of existing conditions by this Contractor.

3.2 PREPARATION

A. Protection:
1. Pay for repairs made by contractors designated by Owner.

2. Identify prepared sod areas requiring protection and erect barriers for proper protection and traffic control.

B. Sodding Areas: Remove weeds, debris and rocks larger than ½” which may hinder sodding. Dispose of accumulated debris at direction of Landscape Architect.

C. Adjustment: Adjust irrigation heads to proper watering height according to depth of sod material but lower than compacted blade height to enable lawn mowers to cut grass freely without damage to the sprinkler system.

D. Fine Grading: Perform as required to maintain positive drainage, prevent ponding and direct run-off into catch basins, drainage structures, etc., and as required to provide smooth well-contoured surface prior to proceeding. Tolerance: ± 0.04 foot.

3.3 FERTILIZING

A. First Application to newly sodded areas: Under Section 02920 2.1C.

3.4 SODDING

A. Sodding:

1. Soil on which sod is laid: Slightly moist.
2. Lay with longest dimension parallel to contours and in continuous rows.
3. Tightly butt ends and sides of sod together. Stagger and compact vertical joints between sod strips by rolling so sod will be incorporated with the ground surface, insuring tight joints between adjacent pieces.

B. Rolling: When soil and sod are moist, roll sod lightly as soon as possible after it is laid. Delay rolling until just before the second watering.

C. Topsoil: Add along exposed edges to match adjacent grade. Feather topsoil out approximately 1 ft. from edge of sod.

D. Drainage: Assure finished areas of sod are such that positive drainage of storm and irrigation water will occur and ponding of water will be minimized.

3.5 REPAIR OF EXISTING SOD AREAS DISTURBED BY RENOVATION

A. Repair existing sod areas disturbed by renovation work (utilities, paving, etc.), as indicated, in accordance with specifications of this section.

3.6 NOTIFICATION OF INSPECTION

A. Notification: Give notice requesting inspection by
Landscape Architect at least 7 days prior to the anticipated date of completion. All sod must be alive and healthy in order to be considered complete.

B. Deficiencies: If deficiencies exist, Landscape Architect shall specify such deficiencies to the Contractor who shall make satisfactory adjustments and will again notify the Landscape Architect for final inspection.

3.7 CLEANING

A. Cleaning: Remove pallets, unused sod, and other debris from site. Clean paved and finished surfaces soiled as a result of work under this Section in accordance with directions given by Landscape Architect. Clean out drainage inlet structures.

3.8 PROTECTION

A. General: Provide and install barriers as required and as directed by Landscape Architect to protect sodded areas against damage form pedestrian and vehicular traffic until acceptance by Owner. Contractor is not responsible for malicious destruction of sodding caused by others.

END OF SECTION 02932
SECTION 02950
TREES, PLANTS AND GROUND COVERS

PART 1 - GENERAL

1.1 SUMMARY:

A. Section Includes:

1. Trees.
2. Plants and shrubs.
4. Non-plant materials required to complete installation of planting.

B. Related Sections:

1. Section 02810 - Irrigation Systems.
2. Section 02900 - Landscape, General.
3. Section 02920 - Soil Preparation.

1.2 REFERENCES:

A. Standards:

1. Plants shall be first-class representatives of the specified species or variety, in healthy condition with normal well-developed branch and root systems, free of objectionable features, and shall conform to requirements as follows:

a. USDA Standards for Nursery Stock.
b. AAN Standardized Specifications.
c. American Joint Committee on Horticulture (AJCH) (plant names shall meet standards of AJCH).

1.3 SUBMITTALS:

A. Certificates of Inspection for Materials:

1. State, Federal, or other inspection certificates shall accompany invoice for materials showing source or origin.
B. Plant List:
   1. Submit list of plants. Refer to Section 01300;
   2. Indicate which plants have special watering requirements.

C. Maintenance Instructions:
   1. At completion of work, furnish three copies of written maintenance instructions to Owner for maintenance and care of installed plants through a full growing season.
   2. Maintenance shall be the responsibility of Landscaping Subcontractor for 1 year after final acceptance of project.
   3. The Owner shall be notified 14 days in advance of the date that maintenance operations will be discontinued.

1.4 QUALITY ASSURANCE:
   A. Inspection and Approval: The Owner reserves the right to reject, at any time or place prior to final acceptance, any materials and plants which in the Owner's opinion fails to meet specified standards requirements.
   B. Inspection of plants is primarily for quality; size and variety, however, other requirements are not waived even though visual inspection results in approval.
   C. Plants may be inspected where growing, but inspection at place of growth shall not preclude the right of rejection at site.
   D. Rejected plants and other materials will be promptly removed from site.

1.5 DELIVERY, STORAGE AND HANDLING:
   A. Fertilizer:
      1. Deliver to site in original unopened container bearing manufacturer's guaranteed chemical analysis, name, trade name, trademark and conformance to Local, State and Federal law.
   B. Protection:
      1. Plants shall be containerized with limbs bound, properly pruned and prepared for shipping.
      2. Root system shall be kept moist and plants shall be protected from adverse conditions.
C. Identification:

1. Each plant shall be identified by means of grower's label affixed to plant.
2. Grower's label will give data necessary to indicate conformance to specifications.
3. Use durable waterproof labels with water resistant ink which will remain legible for at least 60 days.

1.6 SITE CONDITIONS:

A. Repair of lawn watering system, other underground pipe, electrical wiring, concrete walkways, sodded areas or other appurtenances damaged by operations under this Section at no additional cost to the Owner.

1.7 PLANT WARRANTY:

A. For a period of one (1) full growing season after Final Acceptance of Landscape work and at no additional cost to the Owner, the Contractor shall replace any trees, shrubs or ground cover that are dead, or that are, in the opinion of the Owner, in unhealthy, or unsightly condition, or that have lost their natural shape due to dead branches or excessive pruning of dead branches.

B. Replacement of planting shall be in accordance with the original specifications and its cost shall be included.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL:

A. Plant List:

1. Refer to "Schedule" provided in construction drawings.

   LEED WEc1: Water Efficient Landscaping
   When feasible, plants chosen from schedule shall be native and adapted to local climate conditions.

B. Size:

1. Minimum acceptable sizes of plants measured before pruning with branches in normal position.
C. Source:

1. Hardiness Zones:
   a. Shrubs grown in Hardiness Zones 2, 3, 4 and 5 only will be accepted. Hardiness Zones are defined in U.S. Department of Agriculture publications.

2. Nursery Grown:
   a. Plants shall be nursery grown. The term "nursery grown" will include gathered native plants and imported plants that have been growing in a nursery for a minimum of one growing season.

2.2 BACKFILL MATERIAL:

A. Planting mix shall be existing topsoils blended 50%/50% with A1 Premium 3 Organic Compost.

B. Topsoils:

1. Use topsoils stockpiled on site, free from toxic substances, sticks, debris, vegetation and stones over 1" (2.5cm) in maximum dimension.

2. In the event that no suitable topsoil exists after site clearing, the Contractor shall provide adequate topsoil at no additional cost.

3. The Design Consultant shall specify suitable import topsoil material.

2.3 TREE WRAPPING MATERIALS:

A. Will be first quality 4" wide Bituminous impregnated tape, corrugated or crepe paper, brown in color, specifically manufactured for tree wrapping and having qualities to resist insect infestation.

2.4 STAKING AND GUYING MATERIAL:

A. Stakes will be standard wood 8' high stakes.

B. Protective loops will be nylon, of a composition durable enough to last two years.

PART 3 - EXECUTION

3.1 INSTALLATION:
A. Positioning:

1. Shrubs and trees will be placed in position prior to planting, for final acceptance to location by the Owner or Landscape Consultant.

B. Placing Plants:

1. Planting will be done in accord with good horticultural practice or region. Trees should be planted so the top of the root ball is at least one (1) inch above surrounding grade.

C. Excavation of Planting Pit:

1. After preparation of soil, the plant pit, centered on the location stake, shall be excavated in a cylindrical shape with vertical sides and flat or saucer-shaped bottom. Sides of the plant pit shall be scarified. Diameter of plant pit will be at least twice the spread of ball or container.

D. Root Care:

1. Do not remove protective wrapping of root ball or bare roots until plant is positioned accurately in planting pit. When positioned, remove wire mesh and burlap prior to backfilling.
2. Score root balls of containerized shrubs just prior to planting.

E. Pruning and Watering:

1. Plant material will be pruned only to remove dead, injured or lower branches.

   LEED WEc1: Water Efficient Landscaping
   Plant Material specified shall be chosen to minimize water consumption for irrigation.

F. Guying and Staking:

1. Guy and stake in accordance with the standard detail following this section.

G. Tree Mulch Ring.

1. Provide an eight (8) foot diameter mulch ring around each newly planted tree.

3.2 PRE-EMERGENT HERBICIDE:

A. Will be applied as per manufacturer's specification, at Owner’s approval
3.3 MULCHING:
   A. Organic Mulch:
      1. Mulch planting saucers, beds, tree mulch ring and areas within two days after planting.

3.4 PRUNING:
   A. New Plant Material:
      1. Prune minimum necessary to remove injured twigs and branches, deadwood and suckers.

3.5 PLANT MAINTENANCE AND ACCEPTANCE:
   A. Maintenance period will begin immediately after plant material is installed until final acceptance of landscape work.
   B. Maintenance shall include watering, weeding, cultivating, mulching removal of dead branches, restoring plants to proper grade or upright position and other necessary operations.

3.6 SCHEDULE:
   A. Climatological factors directly influence and limit in many ways the possible choices available to the designers of Boulder Campus landscaping.

END OF SECTION 02932
SECTION 03100
CONCRETE FORMWORK

PART 1 - GENERAL

1.1 SUMMARY:

Section Includes:

1. Formwork for cast-in-place concrete.
2. Form accessories.

B. Related Sections:

1. Section 03200 - Concrete Reinforcement.
2. Section 03300 - Cast-in-Place Concrete.
3. Section 03450 - Architectural Precast Concrete.

1.2 REFERENCES:

A. ACI 301: Specifications for Structural Concrete for Buildings.
B. ACI 303: Guide to Cast-in-Place Architectural Concrete Practice.
C. ACI 347: Recommended Practice for Concrete Formwork.
D. PS 1: Construction and Industrial Plywood.

1.3 SUBMITTALS:

A. Shop Drawings:

1. Submit shop drawings for concrete formwork for architectural cast-in-place concrete. Include construction joints, sizes, shapes, materials, gauging information, architectural detailing, openings, clean outs, ties, and other elements affecting appearance. Review will be for general design and appearance factors only.

LEED MRc7: Certified Wood
Demonstrate that all wood products came from "FSC Certified Wood" sources certified by the Forest Stewardship Council. Provide Certification and chain of custody certification, and a record of procurement and use.
1.1 QUALITY ASSURANCE:

A. Field Samples:

1. Field samples under provisions of Section 01300 and coordinate with Section 03300.

2. Sample formwork panel for architectural concrete surfaces.
   a. Special treatment or finish as result of formwork.
   b. Vertical and horizontal form joints.
   c. Typical rustication joints.

3. Provide forms for field mock-ups and samples specified in Section 03300.

PART 2 - PRODUCTS

2.1 FORM MATERIALS:

A. Plywood:

1. Douglas Fir species; select sheathing-tight face grade; sound, undamaged sheets with straight edges.

2. "B-B Medium Density Overlayed Concrete Form", Class I as defined by PS-1.

3. Use new plywood for the project for exposed surfaces. Do not reuse plywood more than four times. Do not use patched forms or plywood previously used on another job for exposed concrete.

LEED MRe7: Certified Wood
Plywood shall come from sources certified by the Forest Stewardship Council (FSC).

B. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to structural tolerances and appearance of finished concrete surface.

C. Tubular Column: Round, of spirally wound, seamless, laminated fiber type; surface treated with release agent.
2.2 FORMWORK ACCESSORIES:

A. Form Ties: Snap-off metal of fixed length; gang form through-bolt, tapered ties -- cone type; 1-1/2 inch break back dimension; free of defects that will leave holes no larger than 1 inch diameter in concrete surface, with waterproofing washer. Gang form through-bolt or tapered tie type, free of defects that will leave holes no larger than 1 inch diameter in concrete surface.

B. Fillets for Chamfered Corners: Wood strips or rigid plastic, 45 degrees, 3/4 inch wing size; maximum possible lengths.

C. Dovetail Anchor Slots: Galvanized steel at brick, concrete block and stone work; 24 gage; foam filled; release tape sealed slots; bent tab anchors; securable to concrete formwork.

D. Flashing Reglets: Galvanized steel; 24 gage; longest possible lengths; release tape sealed slots; with alignment splines for joints; securable to concrete formwork.

E. Form Liners: Fabricated from fiberglass, elastomeric material, or urethane.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Construct formwork to maintain tolerances in accordance with ACI 301. Use Class B formwork tolerances for concrete exposed to view and Class C tolerances for unexposed concrete.

B. Chamfer Strips (ACI 301 4.2.4): Install 45 degree chamfer strips at exposed outside corners, beams, joists and columns.

C. Forms for Exposed Concrete:

1. Drill forms to suit ties used and to prevent leakage of concrete mortar around tie holes. Do not splinter forms by driving ties through improperly prepared holes.

2. Do not use metal cover plates for patching holes or defects in forms.

3. Use extra studs, walers and bracing to prevent bowing of forms between studs and to avoid bowed appearance in concrete. Do not use narrow strips of form material which will produce bow.
4. Assemble forms so they may be readily removed without damage to exposed concrete surfaces.

5. Form molding shapes, recesses and projections with smooth-finish materials, and install in forms with sealed joints to prevent displacement.

3.2 TOLERANCES:

A. Finished concrete surfaces and corners must conform to Table 4.3.1, ACI 301 and ACI 117.

1. Cumulative tolerances will not be acceptable where other materials or elements related to concrete dimensions or positions will have their tolerances or normal adjustments exceeded in a manner affecting their appearance or performance.

B. In addition, architectural concrete surfaces and surfaces to receive thinset tile or other thin finishes are limited to ±0.125" in 10', with no abrupt offsets or changes in plane or other defects that would prevent the proper installation of other materials or adversely affect the finished appearance of the concrete or applied finishes.

| END OF SECTION 03100 | REVIEW TOLERANCES CAREFULLY AND TIGHTEN WHERE NECESSARY DUE TO JOB NEEDS AND WHERE ADDED COST IS JUSTIFIED. FURTHER DEFINE SPECIFIC CUMULATIVE TOLERANCES LIMITS NECESSARY FOR JOB. BEWARE THAT SPRAYED COATINGS, THINSET TILE, PAINT, ETC. REQUIRE NEAR PERFECT SURFACES FOR GOOD APPEARANCE. GRINDING AND FILLING MAY BE MORE FEASIBLE. |
SECTION 03200
CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 SUMMARY:

A. Section Includes:
   1. Reinforcing steel bars, welded steel wire fabric, fabricated steel bar or rod mats for cast-in-place concrete.
   2. Support chairs, bolsters, bar supports, and spacers, for supporting reinforcement.

B. Related Sections:
   1. Section 02380 - Caissons.
   2. Section 02520 - Portland Cement Concrete Paving.
   3. Section 03100 - Concrete Formwork.
   4. Section 03300 - Cast-in-Place Concrete: Concrete placement.
   5. Section 03450 - Architectural Precast Concrete.
   6. Section 04200 - Unit Masonry: Reinforcement for masonry.

1.2 REFERENCES:

A. ACI 301 - Specifications for Structural Concrete for Buildings.
B. ACI 315 - Details and Detailing of Concrete Reinforcement.
C. ASTM A82 - Cold Drawn Steel Wire for Concrete Reinforcement.
D. ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.
E. ASTM A615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
F. ASTM A706 - Low-Alloy Steel Deformed Bars for Concrete Reinforcement.
G. AWS D1.4 - Structural Welding Code Reinforcing Steel.
H. CRSI - Manual of Practice
I. CRSI 63 - Recommended Practice for Placing Reinforcing Bars.
J. CRSI 65 - Recommended Practice for Placing Bar Supports, Specifications and
Nomenclature.

1.3 QUALITY ASSURANCE:

A. Perform concrete reinforcement work in accordance with CRSI Manual of Standard Practice, and Documents 63 and 65.

B. Conform to ACI 301.

C. Submit mill test certificates of supplied concrete reinforcing, indicating physical and chemical analysis.

1.4 Submittals

A. LEED MRc4: Recycled Content
   Provide a statement from the manufacturer stating the recycled content percentage, by weight and whether the recycled content is post-consumer or post-industrial.

B. (LEED MRc5: Regional Materials)
   Provide a statement from the manufacturer stating that materials provided are manufactured within a 500 mile radius of the project and indicate the location.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Reinforcing Steel: ASTM A615 plus (S1) and ASTM A706 for bars where welding is required, Grade 60 if not otherwise specified. Finish: Plain. Epoxy coated rebars will be considered at the design engineer’s recommendation.

   LEED MRc4: Recycled Content
   Material shall contain recycled content when feasible.


C. Stirrup Steel: ASTM A82.

2.2 ACCESSORY MATERIALS:

A. Tie Wire: Minimum 16 gage annealed type. Acceptable patented system.

B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during installation and placement of concrete.

C. Chairs, Bolsters, Bar Supports, Spacers Adjacent to Architectural Concrete Surfaces:
Plastic coated or plastic tipped type; size and shape as required.

2.3 FABRICATION:

A. Fabricate in accordance with ACI 315, providing concrete cover specified in Section 03300.

B. Weld reinforcing bars in accordance with AWS D1.4.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL:

A. Notify Architect 24 hours prior to placement of concrete.

END OF SECTION 03200
SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

B. Related Sections:

1. Section 312000 "Earth Moving" for drainage fill under slabs-on-grade.

1.2 SUBMITTALS

A. Concrete Mix Designs: Submit in accordance with ACI 301.

1. Submit substantiating data for each concrete mix design contemplated for use to the Engineer not less than two weeks prior to first concrete placement. Data for each mix shall, as a minimum, include the following:

a. Mix identification designation (unique for each mix submitted).

b. Statement of intended use for mix.

c. Mixture proportions and descriptions.

d. Water/cementitious materials ratio.

e. Total air content

f. Design slump.

g. Intended method of placement in field.

B. Steel Reinforcement Shop Drawings:

1. Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices, and supports for concrete reinforcement.

2. Show locations of approved construction joints, locations of shrinkage pour strips, splices of reinforcing, type of splice used and splice location, grade of all reinforcement used and specifically identify all ASTM A706 and epoxy coated reinforcing.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

B. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specifications for Structural Concrete"

2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
C. Pre-installation Conference: Conduct conference at project site.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS
   A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
   B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

2.2 STEEL REINFORCEMENT
   A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
   B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice.

2.3 CONCRETE MATERIALS
   A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
      1. Portland Cement: ASTM C 150, Type noted in the structural drawings. Supplement with the following:
      B. Normal-Weight Aggregates: ASTM C 33, graded.
         1. Maximum Coarse-Aggregate Size: as noted in the structural drawings.
      C. Water: ASTM C 94/C 94M

2.4 ADMIXTURES
   B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
      1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
      2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.5 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

2.6 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber

2.7 CONCRETE MIXTURES

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

B. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, and concrete with a water-cementitious materials ratio below 0.50.

C. Proportion normal-weight concrete mixture as defined in the structural drawings.

2.8 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.9 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.
PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Chamfer exterior corners and edges of permanently exposed concrete.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.3 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

3.4 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated in the drawings. Saw-cut contraction joints for a depth equal to at least one-fourth of concrete thickness.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

E. Waterstops: Install in construction joints and at other joints indicated according to manufacturer's written instructions.

3.5 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

C. Cold-Weather Placement: Comply with ACI 306.1.

D. Hot-Weather Placement: Comply with ACI 301.

3.6 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view.

3.7 FINISHING SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restreighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces to be covered with fluid-applied or sheet waterproofing.

C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces as noted in the drawings.
2. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 3/16 inch (4.8 mm).

D. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
3.8 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
   2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.9 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

3.10 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

END OF SECTION 03 30 00