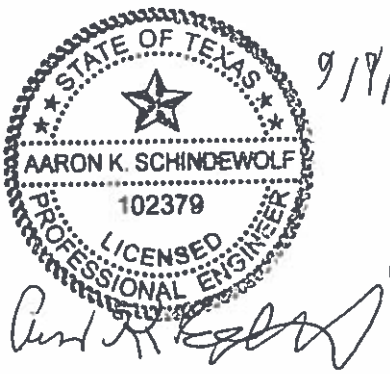

9/9/19

San Jacinto River Authority
Purchasing Department
1577 Dam Site Road
Conroe, Texas 77304

TECHNICAL SPECIFICATIONS AND REQUIREMENTS FOR RFP 19-0086

WOODLANDS DIVISION
LIFT STATION NO. 4 PAVING AND GRADING

SJRA PROJECT NO. WDPR0084.1016.2N001

SAN JACINTO RIVER AUTHORITY TECHNICAL SERVICES DEPARTMENT

Doc. No. **Document Title** **Doc. Date**

SECTION 00 01 10

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USE OF PREMISES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Administrative and procedural requirements for:
    a. Contractor Responsibilities
    b. Temporary Utilities
    c. Limits of Construction
    d. Storage Sheds and Buildings
    e. Working Times
    f. Site Access Times
    g. Notification to Adjacent Occupants
    h. Safety Requirements
    i. First Aid Equipment
    j. Fire Protection
    k. Security Measures
    l. Protection of Utilities, Pipelines, and Property
    m. Surface Restoration
    n. Traffic Control and Use of Public Rights of Way
    o. Contractor’s Roads and Parking
    p. Coordination with Facility Owner’s Operations
    q. Contractor's Field Office
    r. Principal Architect/Engineer's Field Office
    s. Project Photographs
    t. Special Considerations Related to Adjacent Properties and Facilities
    u. Historical and Archaeological Sites

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Proposing Requirements, Contract Forms, and General Conditions of the Contract.

2. Division 01 – General Requirements.
3. Specification Section 31 21 33 – Trenching, Backfilling, and Compacting for Utilities.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

1.3 SUBMITTALS

A. See Specification Section 01 33 00 – Submittals for the requirements for the mechanics and administration of the submittal process.

1.4 CONTRACTOR RESPONSIBITIES

A. Comply with applicable requirements specified in other sections of Project Specifications.

B. Comply with procedures for access to the site and Contractor's use of rights-of-way.

C. Maintain and operate temporary construction facilities and temporary systems to assure continuous service of Owner's and other adjacent existing facilities.

D. Modify and extend temporary systems as Work progress requires.

E. Completely remove materials and equipment when no longer required.

F. Restore existing facilities used for temporary services to original or better condition, or as specified.

G. Prior to installation of material, equipment and/or other work, verify with subcontractors, material or equipment manufacturers, and installers that the substrate or surface to which those materials will attach is acceptable for installation of those materials or equipment. (Substrate is defined as any building or construction surfaces to which materials or equipment are attached to, or required prior to installation i.e., floors, walls, ceilings, soils, utilities, site grading, and backfill etc.).

H. Correct unacceptable substrate until acceptable for installation of equipment or materials.

1.5 TEMPORARY UTILITES

A. Obtaining Temporary Service:

1. Make arrangements with utility service companies for temporary services, unless provided by Owner.
2. Abide by rules and regulations of utility service companies and/or authorities/agencies/entities having jurisdiction.
3. Be responsible for utility service costs and permits until de-mobilization from

site. Included services are fuel, power, light, heat, and any other utility services necessary for execution, completion, testing, and initial operation of Work.

4. Be responsible for providing approved metering devices, as necessary, for any temporary utilities.

B. Water:

1. Contractor to provide water required for performance of Work, specified tests of piping, equipment, devices, or other equipment, and for other uses as necessary.
2. Provide and maintain adequate supply of potable water for consumption by Contractor personnel and Owner's Representatives.
3. Provide necessary approved metering devices and backflow preventers.

C. Electricity and Lighting:

1. Provide electrical service required for Work, including testing of Work. Provide power for lighting, operation of equipment, and other use as necessary.
2. For projects on existing sites, electric power service to be provided includes temporary power service or generator(s) to maintain Owner's operations during scheduled shutdown(s). Coordinate all temporary shutdowns with Owner and Owner's Representative(s).

D. Sanitary Facilities:

1. Provide and maintain sanitary facilities for persons on job site. Comply with regulations of State and local departments of health.
2. Enforce use of sanitary facilities by construction personnel at job site. Enclose sanitary facilities. Pit-type toilets will not be permitted. No discharge will be allowed from these facilities. Collect and store sewage and waste so as not to cause nuisance or health problem. Haul sewage and waste off-site and properly dispose of in accordance with all applicable regulations.
3. Locate toilets near Work site, within 500 feet of working activities for line work projects and secluded from view as best as possible. Keep toilets clean and supplied throughout course of Work. Locate toilets a minimum of 100 feet from all water wells.

1.6 LIMITS OF CONSTRUCTION

A. Construction operations and storage areas are limited to Owner's property, permanent easements, temporary construction easements (TCE), and/or the Limits of Construction or Construction Limits as indicated on the Contract

Drawings.

B. Unauthorized use of areas, or trespassing on land outside of defined limits, is not permitted.

C. Make arrangements, at no cost to the Owner, for Contractor's temporary use of any private properties which may be needed by Contractor for performance of Work. Contractor and Contractor's surety shall indemnify and hold harmless the Owner and Owner's Representatives against claims or demands arising from use of properties outside the Limits of Construction. Submit notarized copy of any separately negotiated agreement(s) between private property owner(s) and Contractor prior to use of area.

D. Where Limits of Construction are shown on Contract Drawings to extend to a property or Right-of-Way line, keep equipment, materials, and stockpiles a minimum of 5 feet from boundary, or existing fence lines.

E. Where utility alignment is within an esplanade and Limits of Construction are shown to extend to edge of the esplanade, keep equipment, materials, and stockpiles a minimum of 5 feet from back of curb.

F. There are unique terms and conditions associated with the various public and private easements, rights-of-entry, encroachment and crossing documents (collectively, the easement documents) which may be site specific. Contractor shall familiarize itself with all easement Documents. Easement documents are available from the Owner on a case by case basis upon request.

G. The Contractor, at its sole expense, shall be responsible for complying with all terms and conditions of all easement documents and the easement rights described therein for this project.

H. Contractor shall safely, properly, and adequately assume and perform all of the duties, indemnities, responsibilities, and liabilities of the Owner under the easement documents.

I. Contractor, at its cost, shall provide all insurance required by the easement documents. All land included within the tracts covered by the easement documents and easements described herein shall be restored to its original condition prior to Substantial Completion of the construction (including, without limitation, repair or replacement of pavement, concrete, signs, fencing, trees, sidewalks, landscaping, shrubbery, and grass) unless otherwise specified in the Contract Documents.

1.7 WORKING TIMES

A. Construction shall be conducted during working hours as indicated in Specification Section 00 72 00 – General Conditions of the Contract, unless otherwise amended by a supplemental specification or agreement to the General Conditions of the Contract, and approved by Owner.

1.8 SITE ACCESS TIMES

A. Contractor to coordinate all site access, including deliveries, outside of working hours with Owner's Representative. Neither Owner nor Owner's Representatives shall sign for any Contractor deliveries. Refer to Specification Section 01 65 50 – Product Delivery, Storage, and Handling.

B. Contractor shall coordinate with Owner to not interfere with Owner's facility operations.

1.9 NOTIFICATION OF ADJACENT OCCUPANTS

A. Notify individual occupants in areas to be affected by Work of proposed construction activities and schedule using a standardized notification form letter and/or door hanger. Notification shall be made not less than 72 hours or more than 2 weeks prior to performance of work within 200 feet of homes or businesses. Coordinate all notifications with Owner's Representative.

B. Include in notification the names and telephone numbers of two Contractor representatives for resident contact available on 24-hour call. Describe precautions that Contractor will take to protect private property and identify potential inconveniences and disruptions to resident's access and utilities.

C. For Contractor's convenience, Owner's Representative will provide an example notice at the pre-construction meeting. In addition to other requirements of this specification regarding notification to adjacent occupants, Contractor's notice is generally to follow the form and content of the example notice.

D. Submit proposed notification(s) to Owner for approval prior to distribution. Provide notice(s) in languages as appropriate (i.e., double sided notice. Notice on one side shall be written in English and flip side shall be written in Spanish).

1.10 SAFETY REQUIREMENTS

A. Beware of overhead power lines existing in area and in close proximity to project. When 10 feet of clearance between energized overhead power line and construction-related activity cannot be maintained, submit a request to the appropriate utility provider to de-energize or move conflicting overhead power line(s).

B. Submit Contractor's Safety Program in accordance with Specification Section 01 33 00 – Submittals. Include Site Safety and Site Security in accordance with Specification Section 00 72 00 – General Conditions of the Contract. Include documented response to trench safety requirements as specified in Specification Section 00 31 32.10 – Trench Safety Geotechnical Information.

C. Conduct operations in strict accordance with the Contractor's Safety Program, in accordance with applicable Federal, State, and local safety codes and statutes, and with good construction practice. Establish and maintain procedures for safety of all work, personnel, and equipment involved in Project.

D. Observe and comply with Texas Occupational Safety Act (Art. 5182a, V.C.S.) and with all safety and health standards promulgated by Secretary of Labor under Section 107 of Contract Work Hours and Standards Act, published in 29 CFR Part 1926 and adopted by Secretary of Labor as occupational safety and health standards under Williams-Steiger Occupational Safety and Health Act of 1970, and to other legislation enacted for safety and health of Contractor employees. Safety and health standards apply to subcontractors and their employees as well as to Contractor and its employees.

E. Observance of and compliance with regulations is solely and without qualification responsibility of Contractor without reliance or superintendence of or direction by the Owner or Owner's Representative. Immediately advise Owner's Representative of investigation or inspection by Federal Safety and Health Inspectors of Contractor or subcontractor's work or place of work on job site under this Contract, and after investigation or inspection, advise Owner's Representative of results. Submit one copy of accident reports to Owner's Representative within 10 days of occurrence.

F. Protect areas occupied by workmen using best available devices for detection of lethal and combustible gases. Test devices frequently to assure functional capability. Constantly observe infiltration of liquids into Work area for visual or odor evidences of contamination, and immediately take appropriate steps to seal off entry of contaminated liquids into Work area.

G. Implement safety measures, including but not limited to safety personnel, first-aid equipment, ventilating equipment, and other safety equipment, as specified or detailed on the Contract Drawings.

H. Maintain required coordination with Police and Fire Departments during entire period covered by Contract.

I. In safety plan, include project safety analysis. Itemize major tasks and potential safety hazards. Plan to eliminate hazards or protect workers and public from each hazard.

1.11 FIRST AID EQUIPMENT

A. Provide first aid kit throughout construction period. List telephone numbers for hospitals, and ambulance services in each first aid kit.

B. Have at least one person thoroughly trained in first aid and cardiopulmonary resuscitation (CPR) procedures present on site whenever Work is in progress. Contractor to conform to protocols and requirements for training and protection against "blood borne pathogens."

1.12 FIRE PROTECTION

A. Conform to specified fire protection and prevention requirements established by Federal, State, or local governmental agencies and as provided in

Contractor's Safety Program.

1.13 SECURITY MEASURES

A. Protect all Work materials, equipment, and property from loss, theft, damage, and vandalism. Perform duty to protect property of the Owner used in connection with performance of Work.

B. If existing fencing or barriers are breached or removed for purposes of construction, provide and maintain temporary security fencing equal to existing.

1.14 PROTECTION OF UTILITIES, PIPELINES, AND PROPERTY

A. Utilize Utility Coordinating Committee One Call System (telephone number, (713) 223-4567), which must be called 48 hours in advance to locate utilities. Toll free telephone number is 1-800-669-8344, Texas (Lone Star) One Call System.

B. Notify Woodlands Joint Powers Association (WJPA) a minimum of 72 hours in advance of any field activities. Telephone number 281-367-1271.

C. Prevent damage to existing utilities during construction. Utilities shown on Drawings are at approximate locations. Pre-locate, by whatever means may be required (metal detection equipment, probes, excavation, survey), underground utilities before excavating in accordance with the Critical Locations investigation described in Specification Section 31 21 33 – Trenching, Backfilling and Compacting for Utilities. Perform investigative work and repairs required after investigation. Contractor is responsible for damages caused by failure to locate and preserve these underground utilities. Give owners of utilities a minimum of five (5) days' notice before commencing Work in area, for locating utilities during construction and for making adjustments or relocation of utilities when they conflict with proposed Work. Include cost for temporary relocation of utilities necessary to accommodate construction in unit costs for utility construction unless otherwise noted on Drawings. Bypassing of sanitary waste to storm drainage facilities is not allowed. Utility service laterals are not shown on Drawings. Contractor shall anticipate that service lines exist and repair them when damaged due to construction activity. No separate payment will be made for repair work. Include payment in unit prices for work in appropriate sections.

D. Contractor shall adhere to each privately owned and operated utility company's construction guidelines when working adjacent-to or across each such entities wet or dry utility.

E. Prior to abandonment of any utility indicated on the Drawings, make arrangements with Owner's Representative and utility owner to terminate service, remove meters, valves, appurtenances, transformers, and/or poles, as required.

F. Utility Outages and Shutdowns: Provide a notification to the Owner's Representative and private utility companies (when applicable) a minimum of 48 hours, excluding weekends and holidays, in advance of required utility shutdown. Shutdown planning and coordination activities shall commence a minimum of 2-weeks prior to scheduled shutdown. Coordinate all work as required.

G. Protect and prevent damage to existing crossing, parallel, and adjacent pipelines during construction in accordance with Specification Section 01 11 13 – Work Covered by Contract Documents.

H. When excavating near product pipelines and prior to start of excavation, request that representative of pipeline company come to the construction site(s) to meet representatives of Contractor and Owner's Representative to discuss actual procedures that will be used. Request that pipeline company's representative probe and locate pipelines in at least three locations: one at each side of proposed excavation and one at centerline of proposed Work. Representative of the pipeline company and Owner's Representative must be present to observe activities of Contractor at all times when excavation is being conducted within 15 feet of existing pipelines.

I. Protection of the Work, and Public and Private Property

1. Take precautions, provide programs, and take actions necessary to protect the Work, and public and private property from damage.
2. Do not alter condition of properties adjacent to and along Limits of Construction.
3. Do not use ways, means, methods, techniques, sequences, or procedures that result in damage to adjacent properties or improvements.
4. Restore properties damaged by Contractor outside of designated Limits of Construction at no cost to Owner.
5. Take action to prevent damage, injury, or loss, including, but not limited to, the following:
    a. Store materials, supplies, and equipment in orderly, safe manner that will not interfere with progress of Work or work of others.
    b. Provide suitable storage for materials subject to damage by exposure to weather, theft, breakage, or otherwise.
    c. Place upon Work or any part thereof only safe loads.
    d. Frequently clean up refuse, rubbish, scrap materials, and debris created by construction operations, keeping Project site safe and orderly.
    e. Provide safe barricades and guard rails to protect pedestrian and vehicular traffic around openings, scaffolding, temporary stairs and

ramps, excavations, elevated walkways, and other hazardous areas.

6. Assume full responsibility for preservation of public and private property on or adjacent to the Limits of Construction. When direct or indirect damage is done by or on account of any act, omission, neglect, or misconduct in execution of Work by Contractor, restore to condition equal to or better than that existing before damage was done.

7. Perform daily clean up in affected construction areas in order to restore site to existing or better conditions. Areas should be free of debris, scrap material, dirt, mud, and other items identified by Owner's Representative. Do not leave buildings, roads, streets, or other construction areas unclean. If deemed necessary by the Owner's Representative, Contractor shall employ street sweeping/cleaning equipment to maintain area streets

J. Barricades and Warning Signals:

1. Where Work is performed on or adjacent to any roadway, right-of-way, or public place, furnish and erect barricades, fences, lights, warning signs, and danger signals, and take other precautionary measures, for protection of persons or property and of the Work.

2. Paint barricades to be visible at night. From sunset to sunrise, furnish and maintain at least one light at each barricade.

3. Erect sufficient barricades to keep vehicles and pedestrians from entering the area under construction.

4. Maintain barricades, signs, lights and provide watchmen until Project is accepted by the Owner or the site has been completely restored to its preconstruction condition.

5. Whenever Work creates encroachment on public roadways, station flagmen to manage traffic flow in accordance with approved traffic control plan. Refer to Specification Section 01 55 26 – Traffic Control.

K. Protection of Existing Structures:

1. Underground Structures:

a. Underground structures are defined to include, but not be limited to, sewer, water, gas, and other piping, manholes, boxes, chambers, electrical signal and communication conduits, tunnels, and other existing subsurface installations located within or adjacent to limits of Work.

b. Known underground structures including water, sewer, electric, and telecommunication services are shown on Contract Drawings. This information is not guaranteed to be correct or complete.

c. Explore ahead of trenching and excavation work and sufficiently uncover obstructing underground structures to determine their location, to prevent

damage to them, and to prevent interruption of utility services. Restore underground structures to original conditions at no additional cost if damaged during construction.

d. Locate and protect private lawn sprinkler systems which may exist within site. Repair or replace damaged systems to condition existing at start of Work, or better.

e. Necessary changes in location of Work may be made by the Owner to avoid unanticipated underground structures.

f. If permanent relocation of underground structures or other subsurface installations is required and not otherwise provided in Contract, the Owner will direct Contractor in writing to perform Work, which is paid for under provisions for changes as described in Specification Section 00 72 00 - General Conditions of the Contract.

2. Surface Structures: Surface structures are defined as existing buildings, structures and other constructed installations above ground surface. Included with structures are their foundations and any extensions below the surface. Surface structures include, but are not limited to buildings, tanks, walls, bridges, roads, dams, channels, open drainage, piping, poles, wires, posts, signs, markers, curbs, walks, guard cables, fencing, and other facilities visible above ground surface.

3. Existing Condition Survey: Contractor shall survey and adequately document the condition and elevation of existing structures adjacent to the proposed alignment.

4. Protection of Underground and Surface Structures:

a. Support in place and protect from direct or indirect damage underground and surface structures located within or adjacent to limits of Work.

b. Prevent overstress or damage to any structure and any part or member of structures during construction. This applies to new and existing facilities, utilities, and structures affected by construction operations. Contractor shall monitor and record the effect of its construction operations on new and existing facilities, utilities, and structures, and shall provide engineered temporary supports and connections as required to assure the safety and stability of the structures and prevent overstress of any part. Employ a registered Professional Engineer licensed in the State of Texas to design temporary supports to assure safety and integrity of structures and facilities.

c. Install temporary supports carefully and as required by party owning or controlling structure. Before installing structure supports, satisfy Owner's Representative that methods and procedures have been approved by

owner of structure.

d. Avoid moving or changing property of public utilities or private corporations without prior written consent of responsible official of that service or public utility. Representatives of these utilities reserve the right to enter within limits of this Project for purpose of maintaining their properties, or of making changes or repairs to their property that may be considered necessary by performance of this Contract.

e. Notify owners and/or operators of utilities and pipelines adjacent to the Work of the nature of construction operations and dates when operations will be performed. When construction operations are required in immediate vicinity of existing structures, pipelines, or utilities, give minimum of 5 working days advance notice. Probe and flag location of underground utilities prior to commencement of excavation. Keep flags in place until construction operation reaches and uncovers utility.

f. Assume risks attending presence or proximity of underground and surface structures within or adjacent to Work including but not limited to damage and expense for direct or indirect damage caused by Contractor's Work to structure. Immediately repair damage.

L. Protection of Installed Products:

1. Provide protection of installed products to prevent damage from subsequent operations. Remove protection facilities when no longer needed, prior to final completion of Work.

2. Control traffic to prevent damage to equipment, materials, and surfaces.

3. Provide coverings to protect equipment and materials from damage. Cover projections, wall corners, jambs, sills, and exposed sides of openings in areas used for traffic and passage of materials in subsequent work.

1.15 SURFACE RESTORATION

A. Restore site to the condition which existed before construction in accordance with Specification Section 01 74 23 – Restoration of Site, unless otherwise noted in Contract Documents.

B. For projects not having well defined phases, the total linear footage of project rights-of-way and/or easements that may be disturbed at any given time, shall be limited to no more than fifty (50) percent of the total project linear footage or 1,000 linear feet, whichever is less. Accordingly, disturbed areas shall be restored in accordance with Specification Section 01 74 23 – Restoration of Site prior to proceeding with Work that would exceed the fifty (50) percent total project disturbed length or 1,000 linear feet, whichever is less.

1.16 TRAFFIC CONTROL AND USE OF PUBLIC RIGHTS OF WAY

A. Comply with traffic regulation in accordance with Specification Section 01 55 26 - Traffic Control, and approved traffic control plan(s).

B. Provide barricades and signs in accordance with Section VI of the State of Texas Manual on Uniform Traffic Control Devices.

C. Obtain necessary permits and Owner's approval when the nature of Work requires closing an entire street. Obtaining permits required for street closure are the Contractor's responsibility. Avoid unnecessary inconvenience to abutting property owners. Avoid closing more than two (2) consecutive intersections at one time, except by permission of Owner.

D. Notify Owner's Representative at least 48 hours prior to closing a street or street crossing. It is the Contractor's responsibility to obtain all required permits for street closures in advance.

E. Maintain 10-foot-wide minimum access lane for emergency vehicles, including access to fire hydrants, at all times.

F. Remove surplus materials and debris and open each 500 lineal foot length of roadway for public use when work within that length is complete.

G. Contractor shall provide and install signs indicating entrances to businesses whose normal entry is impaired or detoured as a result of construction. Proposed signs shall be submitted to the Owner's Representative for approval prior to manufacture and installation.

H. Final acceptance of any portion of Work is not based on return of roadway to public use.

I. Avoid obstructing driveways or entrances to private property.

J. Provide temporary access or complete excavation and backfill in one continuous operation to minimize duration of obstruction when excavation is required across drives or entrances.

K. Contractor shall bear the sole responsibility for damage to existing traffic cables resulting from its construction activities. The Contractor shall be responsible for the repair of damaged traffic cables including the re-cabling of the entire intersection if required, at no additional cost to the Owner.

L. Construct and maintain temporary detours, ramps, and/or roads to provide for normal public traffic flow when use of public roads or streets is closed by necessities of Work. Contractor shall obtain all required roadway closure or detour permits in advance of commencing the proposed temporary detour, ramps, and/or roadway Work.

M. Provide mats or other means to prevent overloading or damage to existing roadways from tracked equipment, large tandem axle trucks or equipment that

will damage existing roadway surface. Contractor shall repair or replace damaged roadway not scheduled for removal and/or replacement at no additional cost to the Owner. Repairs or replacement shall be in conformance with the roadway owner's requirements.

N. Provide daily sweeping of hard-surface roadways to remove soils tracked onto public roadways.

1.17 CONTRACTORS ROADS AND PARKING

A. Prevent interference with traffic on existing roads.

B. Construct and maintain temporary access roads and parking areas.

C. Designate temporary parking areas to accommodate Contractor's and Owner's Representative personnel. When site space is not adequate, provide additional off-site parking. Locate as approved by Owner's Representative.

D. Minimize use by construction traffic of existing streets and driveways.

E. Do not allow heavy vehicles or construction equipment in existing parking areas.

F. Do not inhibit the ability of the Owner's personnel to access, operate, and maintain existing facilities during construction.

1.18 SPECIAL CONSIDERATIONS RELATED TO ADJACENT PROPERTIES AND FACILITIES

A. Contractor shall be responsible for negotiations of any waivers or alternate arrangements required to enable transportation of materials to the site.

B. Maintain conditions of access road to site such that access is not hindered as the result of construction related deterioration.

1. Provide daily sweeping of hard-surface roadways to remove soils tracked

1.19 WARRANTY (NOT USED)

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 MAINTENANCE

A. Maintain temporary facilities in a clean, neat, and orderly manner including maintenance of all-weather surface driveway and parking areas, buildings and furnishings, and equipment or materials furnished and supplied as part of any

B. At this office, maintain complete field file of Shop Drawings, posted Drawings and Specifications, and other files of field operations including provisions for maintaining "As Built Drawings."

C. Immediately repair damage, leaks, or defective service.

3.2 OWNER TRAINING (NOT USED)

END OF SECTION

SECTION 01 33 00

SUBMITTALS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mechanics and administration of the submittal process for:
    a. Shop Drawings.
    b. Samples.
    c. Miscellaneous submittals.
    d. Operation and Maintenance Manuals.
2. General content requirements for Shop Drawings.
3. Content requirements for Operation and Maintenance Manuals.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Sections in Divisions 02 through 48 identifying required submittals.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

1.3 SUBMITTALS (NOT USED)

1.4 DEFINITIONS

A. Shop Drawings:

1. See General Conditions.
2. Product data and samples are Shop Drawing information.

B. Operation and Maintenance (O&M) Manuals:

1. Contain the information required for proper installation and maintenance of building materials and finishes.
2. Contain the technical information required for proper installation, operation and maintenance of process, electrical and mechanical equipment and systems.

C. Miscellaneous Submittals:

1. Submittals other than Shop Drawings and O&M Manuals.

2. Representative types of miscellaneous submittal items include but are not limited to:
    a. Construction schedule.
    b. Facility Shutdown Plan(s)
    c. HVAC test and balance reports.
    d. Installed equipment and systems performance test reports.
    e. Manufacturer's installation certification letters.
    f. Instrumentation and control commissioning reports.
    g. Warranties.
    h. Service agreements.
    i. Construction photographs.
    j. Record Documents.
    k. Cost breakdown (Schedule of Values).
    l. Safety Plan(s).

1.5 SUBMITTAL SCHEDULE

A. Schedule of Shop Drawings:
    1. Submitted and approved within 20 days of receipt of Notice to Proceed.
    2. Account for multiple transmittals under any specification section where partial submittals will be transmitted.

1.6 PREPARATION OF SUBMITTALS

A. General:
    1. All submittals and all pages of all copies of a submittal shall be completely legible.
    2. Submittals which, in the Owner’s Representative’s or Principal Architect/Engineer’s sole opinion, are illegible will be returned without review.

B. Shop Drawings:
    1. Scope of any submittal and shop drawing transmittal:
        a. Submit shop drawings utilizing Owner’s standard Submittal Transmittal Form.
        b. Limited to one (1) Specification Section.
        c. Do not submit under any Specification Section entitled (in part) "Basic Requirements" unless the product or material submitted is specified, in total, in a “Basic Requirements” Section.
    2. Numbering letter of transmittal:

a. Include a series number, "xx", beginning with "01" and increasing sequentially with each additional transmittal.

b. Assign consecutive series numbers to subsequent transmittals.

3. Describing transmittal contents:

   a. Provide listing of each component or item in submittal capable of receiving an independent review action.

   b. Identify for each item:

      1) Manufacturer and Manufacturer's Drawing or data number.

      2) Contract Document tag number(s).

      3) Unique page numbers for each page of each separate item.

      4) Use divider sheets with labeled tabs to separate independent items within a single submittal.

   c. When submitting "or-equal" items that are not the products of named manufacturers, include the words "or-equal" in the item description.

4. Contractor stamping:

   a. General:

      1) Contractor's review and approval stamp shall be applied either to the letter of transmittal or a separate sheet preceding each independent item in the submittal.

         a) Contractor's signature and date shall be wet ink signature. Is an electronic signature acceptable as most submittals are uploaded to SharePoint as a .PDF electronic document?

      2) Submittals containing multiple independent items shall be prepared with an index sheet for each item listing the discrete page numbers for

each page of that item, which shall be stamped with the Contractor's review and approval stamp.

a) Individual pages or sheets of independent items shall be numbered in a manner that permits Contractor's review and approval stamp to be associated with the entire contents of a particular item.

b) Use divider sheets with labeled tabs to separate independent items within a single submittal.

b. Electronic stamps:

1) Contractor may electronically embed Contractor's review and approval stamp to either the Submittal Transmittal Form or a separate index sheet preceding each independent item in the submittal.

2) Contractor's signature and date on electronically applied stamps shall be wet ink signature. Is an electronic signature acceptable as most submittals are uploaded to SharePoint as a PDF electronic document?

5. Resubmittals:

a. Number with original root number and a suffix letter starting with "A" on a new Submittal Transmittal Form.

b. Do not increase the scope of any prior transmittal.

c. Account for all components of prior transmittal.

1) If items in prior transmittal received "A" or "B" Action code, list them and indicate "A" or "B" as appropriate (See also 1.6, this Section).

a) Do not include submittal information for items listed with prior "A" or "B" in resubmittal.

2) Indicate items to be resubmitted “at a later date” for any prior "C" or "D" Action item not included in resubmittal.

a) Obtain Principal Architect/Engineer’s approval to exclude items.

6. For 8-1/2 x 11 In, 8-1/2 x 14 In, and 11 x 17 In hard copy size sheets, provide three (3) copies of each page for Principal Architect/Engineer’s plus

the number required by the Contractor. In today's electronic environment, is subsection No. 6 necessary to be included in the contract documents?

a. All other hard copy size sheets:

1) Submit one (1) reproducible transparency or high resolution print and one (1) additional print of each Drawing until approval is obtained.

2) Utilize mailing tube; do not fold.

3) The Principal Architect/Engineer will mark and return the reproducible to the Contractor through the Owner's Representative for his reproduction and distribution.

7. Electronic submittals utilizing web based document management system (SharePoint®):

a. Shop drawing submittals shall be produced (scanned) in Adobe Acrobat's Portable Document Format (PDF) Version 5.0 or higher.

b. Do not password protect and/or lock the PDF document.

c. Create one (1) PDF document (PDF file) for each submittal.

d. Drawings or other graphics must be converted to PDF format and made part of the singe (one [1]) PDF document.

1) Scanning to be used only where actual file conversion is not possible.

e. Limit PDF document size to 5MB.

f. Rotate pages that must be viewed in landscape to the appropriate position for easy reading.

g. Images only shall be scanned at a resolution of 300 dpi or greater.

1) Perform Optical Character Recognition (OCR) capture on all images.

2) Achieve OCR with the "original image with hidden text" option.

3) Word searches of the PDF document must operate successfully to demonstrate OCR compliance.

h. Create bookmarks in the navigation frame, for each entry in the Table of Contents/Index.

1) Normally three (3) levels deep (i.e., "Chapter," "Section," "Sub-section").

i. Thumbnails must be generated for each PDF file.

j. Set the opening view for PDF files as follows:

1) Initial view: Bookmarks and Page.

2) Magnification: Fit in Window.

3) Page layout: Single page.

4) Set the file to open to the cover page of the submittal with bookmarks to the left, and the first bookmark linked to the cover page.

k. All PDF documents shall be set with the option "Fast Web View" to open the first pages of the document for the viewer while the rest of the document continues to load.

l. File naming conventions:

1) File names shall use a "nine dot three" convention (XXXXXX-YY-Z.PDF) where XXXXXX is the Specification Section number, YY is the

Shop Drawing Root series number and Z is an ID number used to designate the associated volume.

a) Example 1:

(1) Two (2) pumps submitted as separate Shop Drawings under the same Specification Section:

(a) Pump 1 = 43 21 21-01-1.pdf.

(b) Pump 2 = 43 21 21-02-1.pdf.

b) Example 2:

(1) Control system submitted as one (1) Shop Drawing but separated into two (2) shop drawing submittals:

(a) Volume 1 = 40 90 00-01-1.pdf.

(b) Volume 2 = 40 90 00-01-2.pdf.

8. Provide clear space (3 In Sq) for Principal Architect/Engineer stamping of each component defined in the PREPARATION OF SUBMITTALS Article – Contractor Stamping.
9. Contractor shall not use red color for marks on transmittals.
   a. Duplicate all marks on all copies transmitted, and ensure marks are photocopy reproducible.
   b. Outline Contractor marks on reproducible transparencies with a rectangular box.
10. Transmittal contents:
   a. Coordinate and identify Shop Drawing contents so that all items can be easily verified by the Owner's Representative and the Principal Architect/Engineer.
   b. Identify equipment or material use, tag number, Drawing detail reference, weight, and other Project specific information.
   c. Provide sufficient information together with technical cuts and technical data to allow an evaluation to be made to determine that the item submitted is in compliance with the Contract Documents.
   d. Submit items such as equipment brochures, cuts of fixtures, product data sheets or catalog sheets on 8-1/2 x 11 In pages.
      1) Clearly mark (indicate) exact item or model and all options proposed.
   e. When a Shop Drawing submittal is called for in any Specification Section, include as appropriate, scaled details, sizes, dimensions, performance characteristics, capacities, test data, anchoring details, installation instructions, storage and handling instructions, color charts, layout Drawings, rough-in diagrams, wiring diagrams, controls, weights and

other pertinent data in addition to information specifically stipulated in the Specification Section.

1) Arrange data and performance information in format similar to that provided in Contract Documents.

2) Provide, at minimum, the detail specified in the Contract Documents.

f. Provide warranty information.

g. If proposed equipment or materials deviate from the Contract Drawings or Specifications in any way, clearly note the deviation and justify the said deviation in detail in a separate letter immediately following transmittal sheet.

11. Samples:

a. Identification:

1) Identify sample as to transmittal number, manufacturer, item, use, type, project designation, tag number, standard Specification Section

or Drawing detail reference, color, range, texture, finish and other pertinent data.

2) If identifying information cannot be marked directly on sample without defacing or adversely altering samples, provide a durable tag with identifying information securely attached to the sample.

b. Include application specific brochures, and installation instructions.

c. Provide Contractor's stamp of approval on samples or transmittal form as indication of Contractor's checking and verification of dimensions and coordination with interrelated work.

d. Resubmit samples of rejected items.

C. Miscellaneous Submittals:

1. Prepare in the format and detail specified in Specification requiring the miscellaneous submittal.

D. Operation and Maintenance Manuals:

1. Owner's use of manufacturer's Operation and Maintenance materials:

a. Materials are provided for Owner's use, reproduction and distribution as training and reference materials within Owner's organization.

1) Applicable to hard copy or electronic media.

2) Applicable to materials containing copyright notice as well as those with no copyright notice.

b. Notify manufacturer of this intended use of materials provided under the Contract.

2. Number each Operation and Maintenance Manual transmittal with the original root number of the associated Shop Drawing.

a. Identify resubmittals with the original number plus a suffix letter starting with "A."

3. Submittal format:

a. Interim submittals: Submit two (2) paper copies until manual is approved.

b. Final submittals:

1) Within 30 days of receipt of approval, submit one (1) additional paper copy and two (2) electronic copies to the Owner’s Document

Management System (SharePoint) in Portable Document Format (PDF).

a) Compact discs to be secured in jewel cases.

2) Electronic copies will be reviewed for conformance with the approved paper copy and the electronic copy (PDF) requirements of this Specification.

3) Non-conforming CDs will be returned with comments.

a) Provide final CDs within 30 days of receipt of comments.

4. Paper copy submittals:

a. Submit Operation and Maintenance Manuals printed on 8-1/2 x 11 In size heavy first quality paper with standard three-hole punching and bound in

appropriately sized three-ring (or post) vinyl view binders with clear overlays front, spine and back.

1) Provide binders with titles inserted under clear overlay on front and on spine of each binder.
   a) As space allows, binder titles shall include, but not necessarily be limited to, Project Name, related Specification Number, Equipment Name(s) and Project Equipment Tag Numbers.
2) Provide a Cover Page for each manual with the following information:
   a) Manufacturer(s).
   b) Date.
   c) Project Owner and Project Name.
   d) Specification Section.
   e) Project Equipment Tag Numbers.
   f) Model Numbers.
   g) Principal Architect/Engineer.
   h) Contractor.
3) Provide a Table of Contents or Index for each manual.
4) Use plastic-coated dividers to tab each section of each manual per the manual's Table of Contents/Index for easy reference.
5) Provide plastic sheet lifters prior to first page and following last page.

b. Reduce Drawings or diagrams bound in manuals to an 8-1/2 x 11 In or 11 x 17 In size.
   1) Where reduction is not practical to ensure readability, fold larger Drawings separately and place in vinyl envelopes which are bound into the binder.
   2) Identify vinyl envelopes with Drawing numbers.

c. Mark each sheet to clearly identify specific products and component parts and data applicable to the installation for the Project.
   1) Delete or cross out information that does not specifically apply to the Project.

5. Electronic copy submittals:
   a. Electronic copies of the approved paper copy Operation and Maintenance Manuals are to be produced in Adobe Acrobat's Portable Document Format (PDF) Version 5.0 or higher.
   b. Do not password protect and/or lock the PDF document.

c. Create one (1) PDF document (PDF file) for each equipment O&M Manual.

d. Drawings or other graphics must be converted to PDF format and made part of the one (1) PDF document.

   1) Scanning to be used only where actual file conversion is not possible.

e. Rotate pages that must be viewed in landscape to the appropriate position for easy reading.

f. Images only shall be scanned at a resolution of 300 dpi or greater.

   1) Perform Optical Character Recognition (OCR) capture on all images.

   2) Achieve OCR with the "original image with hidden text" option.

   3) Word searches of the PDF document must operate successfully to demonstrate OCR compliance.

g. Create bookmarks in the navigation frame, for each entry in the Table of Contents/Index.

   1) Normally three (3) levels deep (i.e., "Chapter," "Section," "Sub-section").

h. Thumbnails must be generated for each PDF file.

i. Set the opening view for PDF files as follows:

   1) Initial view: Bookmarks and Page.

   2) Magnification: Fit in Window.

   3) Page layout: Single page.

   4) Set the file to open to the cover page of the manual with bookmarks to the left, and the first bookmark linked to the cover page.

j. All PDF documents shall be set with the option "Fast Web View" to open the first pages of the document for the viewer while the rest of the document continues to load.

k. File naming conventions:

   1) File names shall use a "ten dot three" convention (XXXXXX-YY-Z.PDF) where XXXXXX is the Specification Section number, YY is the

Shop Drawing Root number and Z is an ID number used to designate the associated volume.

a) Example 1:

(1) Two (2) pumps submitted as separate Shop Drawings under the same Specification Section:

(a) Pump 1 = 43 21 21-01-1.pdf.

(b) Pump 2 = 43 21 21-02-1.pdf.

b) Example 2:

(1) Control system submitted as one (1) Shop Drawing but separated into two (2) O&M volumes:

(a) Volume 1 = 40 90 00-01-1.pdf.

(b) Volume 2 = 40 90 00-01-2.pdf.

l. Labeling:

1) As a minimum, include the following labeling on all CD-ROM discs and jewel cases:

a) Project Name.

b) Equipment Name and Project Tag Number.

c) Project Specification Section.

d) Manufacturer Name.

e) Vendor Name.

m. Binding:

1) Include labeled CD(s) in labeled jewel case(s).

a) Bind jewel cases in standard three-ring binder Jewel Case Page(s), inserted at the front of the Final paper copy submittal.

b) Jewel Case Page(s) to have means for securing Jewel Case(s) to prevent loss (e.g., flap and strap).

6. Operation and Maintenance Manuals for Materials and Finishes:

a. Building Products, Applied Materials and Finishes:

1) Include product data, with catalog number, size, composition and color and texture designations.

2) Provide information for re-ordering custom manufactured products.

b. Instructions for Care and Maintenance:

1) Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods and recommended schedule for cleaning and maintenance.

c. Moisture Protection and Weather Exposed Products:

1) Include product data listing, applicable reference standards, chemical composition, and details of installation.

2) Provide recommendations for inspections, maintenance and repair.

d. Additional requirements as specified in individual product specifications.

7. Operation and Maintenance Manuals for Equipment and Systems:

a. Submission of Operation and Maintenance Manuals for equipment and systems is applicable but not necessarily limited to:

1) Major equipment.

2) Equipment powered by electrical, pneumatic or hydraulic systems.

3) Specialized equipment and systems including instrumentation and control systems and system components for HVAC process system control.

4) Valves and water control gates.

b. Equipment and Systems Operation and Maintenance Manuals shall include, but not necessarily be limited to, the following completed forms and detailed information, as applicable:

1) Fully completed type-written copies of the associated Equipment Record(s), Exhibits A1, A2 and A3, shall be included under the first

tab following the Table of Contents of each Operation and Maintenance Manual.

a) Each section of the Equipment Record must be completed in detail.

(1) Simply referencing the related manual for nameplate, maintenance, spare parts or lubricant information is not acceptable.

b) For equipment items involving components or subunits, a fully completed Equipment Record Form is required for each operating component or subunit.

c) Submittals that do not include the associated Equipment Record(s) will be rejected without further content review.

d) Electronic copies of the Exhibits may be obtained by contacting the Project Manager.

2) Equipment function, normal operating characteristics, limiting operations.

3) Assembly, disassembly, installation, alignment, adjustment, and checking instructions.

4) Operating instructions for start-up, normal operation, control, shutdown, and emergency conditions.

5) Lubrication and maintenance instructions.

6) Troubleshooting guide.

7) Parts lists:

a) Comprehensive parts and parts price lists.

b) A list of recommended spare parts.

c) List of spare parts provided as specified in the associated Specification Section.

8) Outline, cross-section, and assembly Drawings; engineering data; and electrical diagrams, including elementary diagrams, wiring diagrams,

connection diagrams, word description of wiring diagrams and interconnection diagrams.

9) Test data and performance curves.

10) As-constructed fabrication or layout Drawings and wiring diagrams.

11) Instrumentation or tag numbers assigned to the equipment by the Contract Documents are to be used to identify equipment and system components.

12) Additional information as specified in the associated equipment or system Specification Section.

1.7 TRANSMITTAL OF SUBMITTALS

A. Shop Drawings, Samples and Operation and Maintenance Manuals:

1. Transmit all submittals via Owner's Document Management System (SharePoint).
2. Transmit all paper submittals to the address provided below.

San Jacinto River Authority Woodlands Division

2436 Sawdust Road

The Woodlands, Texas 77380

Attn: Construction Manager - TBD

3. Utilize SJRA Standard Submittal Transmittal Form (to be provided by Owner) to transmit all Shop Drawings, Samples and Operation and Maintenance Manuals.
4. All submittals must be from Contractor.
   a. Submittals will not be received from or returned to subcontractors.
   b. Operation and Maintenance Manual submittal stamp may be Contractor's standard approval stamp.
5. Provide submittal information defining specific equipment or materials utilized on the Project.
   a. Generalized product information, not clearly defining specific equipment or materials to be provided, will be rejected.

B. Miscellaneous Submittals:

1. Transmit under Contractor's standard Submittal Transmittal Form or letterhead.
2. Submit in triplicate or as specified in individual Specification Section.
3. Transmit to the address provided below.

San Jacinto River Authority – Woodlands Division

2436 Sawdust Road

The Woodlands, Texas 77380

Attn: Construction Manager - TBD

4. Provide copy of Submittal Transmittal without attachments to Owner's Representative.

C. Expedited Return Delivery:

1. Include prepaid express envelope or airbill in submittal transmittal package for any submittals Contractor expects or requires express return mail.
2. Inclusion of prepaid express envelope or airbill does not obligate Owner's Representative or Principal Architect/Engineer to conduct expedited review of submittal.

D. Fax Transmittals:

1. Permitted on a case-by-case basis to expedite review when approved by Principal Architect/Engineer.
2. Requires hard copy transmittal to immediately follow.
   a. Principal Architect/Engineer will proceed with review of fax transmittal.
   b. Principal Architect/Engineer 's approval or rejection comments will be recorded and returned on hard copy transmittal.
3. Provisions apply to both:
   a. Initial transmittal contents.
   b. Supplemental information required to make initial transmittal contents complete.

1.8 PRINCIPAL ARCHITECT/ENGINEER 'S REVIEW ACTION

A. Shop Drawings and Samples:

1. Items within transmittals will be reviewed for overall design intent and will receive one of the following actions:
   a. NO EXCEPTION.
   b. EXCEPTIONS AS NOTED.
   c. REVISE & RESUBMIT
   d. REJECTED - RESUBMIT.
   e. ACKNOWLEDGE RECEIPT.
   f. FOR INFORMATION PURPOSES ONLY.

g. SUPPLEMENTARY INFORMATION.

2. Submittals received will be initially reviewed to ascertain inclusion of Contractor's approval stamp.
   a. Submittals not stamped by the Contractor or stamped with a stamp containing language other than that specified herein will not be reviewed for technical content and will be returned without any action.
3. In relying on the representation on the Contractor's review and approval stamp, Owner and Principal Architect/Engineer reserve the right to review and process poorly organized and poorly described submittals as follows:
   a. Submittals transmitted with a description identifying a single item and found to contain multiple independent items:
      1) Review and approval will be limited to the single item described on the transmittal letter.
      2) Other items identified in the submittal will:
         a) Not be logged as received by the Principal Architect/Engineer.
         b) Be removed from the submittal package and returned without review and comment to the Contractor for coordination, description and stamping.
         c) Be submitted by the Contractor as a new series number, not as a re-submittal number.
   b. Principal Architect/Engineer, at Principal Architect/Engineer's discretion, may revise the transmittal letter item list and descriptions, and conduct review.
      1) Unless Contractor notifies Principal Architect/Engineer in writing that the Principal Architect/Engineer's revision of the Submittal Transmittal Form item list and descriptions was in error, Contractor's review and

approval stamp will be deemed to have applied to the entire contents of the submittal package.

4. Submittals returned with Action "A" or "B" are considered ready for fabrication and installation.
   a. If for any reason a submittal that has an "A" or "B" Action is resubmitted, it must be accompanied by a letter defining the changes that have been made and the reason for the resubmittal.
   b. Destroy or conspicuously mark "SUPERSEDED" all documents having previously received "A" or "B" Action that are superseded by a resubmittal.
5. Submittals with Action "A" or "B" combined with Action "C" (Revise and Resubmit) or "D" (Rejected) will be individually analyzed giving consideration as follows:
   a. The portion of the submittal given "C" or "D" will not be distributed (unless previously agreed to otherwise at the Preconstruction Conference).
      1) One (1) copy or the one (1) transparency of the "C" or "D" Drawings will be marked up and returned to the Contractor.
         a) Correct and resubmit items so marked.
   b. Items marked "A" or "B" will be fully distributed.
   c. If a portion of the items or system proposed are acceptable, however, the major part of the individual Drawings or documents are incomplete or require revision, the entire submittal may be given "C" or "D" Action.
      1) This is at the sole discretion of the Principal Architect/Engineer.
      2) In this case, some Drawings may contain relatively few or no comments or the statement, "Resubmit to maintain a complete package."
      3) Distribution to the Owner and field will not be made (unless previously agreed to otherwise).
6. Failure to include any specific information specified under the submittal paragraphs of the Specifications will result in the submittal being returned to the Contractor with "C" or "D" Action.
7. Calculations: Requirements for the submittal of calculations in the individual Specification Sections shall be satisfied through the submittal of a certification sealed by the Principal Architect/Engineer that the calculations have been performed. Certification will be received for information purposes only and will be returned stamped "D. ACKNOWLEDGE RECEIPT ".
8. Transmittals of submittals which the Principal Architect/Engineer considers as "Not Required" submittal information, which is supplemental to but not essential to prior submitted information, or items of information in a transmittal which have been reviewed and received "A" or "B" Action in a

prior submittal, will be returned with Action "E. Acknowledge Receipt" (Principal Architect/Engineer 's Review Not Required).

9. Samples may be retained for comparison purposes.
   a. Remove samples when directed.
   b. Include in bid all costs of furnishing and removing samples.
10. Approved samples submitted or constructed, constitute criteria for judging completed work.
    a. Finished work or items not equal to samples will be rejected.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

EXHIBIT A1

Equipment Record

Equipment Data and Spare Parts Summary

Project Name	Specification Section:
Equipment Name	Year Installed:
Project Equipment Tag No(s).	
Equipment Manufacturer	Project/ Order No.
Address	Phone
Fax / Web Site / E-mail	
Local Vendor/Service Center	
Address	Phone
Fax / Web Site / E-mail	

MECHANICAL NAMEPLATE DATA

Equip.		Serial No.		
Make		Model No.		
ID No.	Frame No.	HP	RPM	Cap.
Size	TDH	Imp. Sz.	CFM	PSI
Other:				

ELECTRICAL NAMEPLATE DATA

Equip.				Serial No.				
Make				Model No.				
ID No.	Frame No.	HP	V.	Amp.	HZ	PH	RPM	SF
Duty	Code	Ins. Cl.	Type	NEMA	C Amb.	Temp. Rise	Rating	
Other:								

SPARE PARTS PROVIDED PER CONTRACT

Part No.	Part Name	Quantity

RECOMMENDED SPARE PARTS

Part No.	Part Name	Quantity

EXHIBIT A2
Equipment Record

Recommended Maintenance Summary

Equipment Description	Project Equip. Tag No(s).

RECOMMENDED BREAK-IN MAINTENANCE (FIRST OIL CHANGES, ETC.)	INITIAL COMPLETION * FOLLOWING START-UP						
	D	W	M	Q	S	A	Hours

RECOMMENDED PREVENTIVE MAINTENANCE	PM TASK INTERVAL *						
	D	W	M	Q	S	A	Hours

* D = Daily W = Weekly M = Monthly Q = Quarterly S = Semiannual A = Annual Hours = Run Time Interval

EXHIBIT A3

Equipment Record

Lubrication Summary

Equipment Description	Project Equip. Tag No(s).

Lubricant Point						
		Manufacturer	Product	AGMA #	SAE #	ISO
Lubricant Type	1					
	2					
	3					
	4					
	5					

Lubricant Point						
		Manufacturer	Product	AGMA #	SAE #	ISO
Lubricant Type	1					
	2					
	3					
	4					
	5					

Lubricant Point						
		Manufacturer	Product	AGMA #	SAE #	ISO
Lubricant Type	1					
	2					
	3					
	4					
	5					

Lubricant Point						
		Manufacturer	Product	AGMA #	SAE #	ISO
Lubricant Type	1					
	2					
	3					
	4					
	5					

Lubricant Point						
		Manufacturer	Product	AGMA #	SAE #	ISO
Lubricant Type	1					
	2					
	3					
	4					
	5					

Lubricant Point						
		Manufacturer	Product	AGMA #	SAE #	ISO
Lubricant Type	1					
	2					
	3					
	4					
	5					

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SECTION 01 56 39

TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for tree and plant protection.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Unless a separate bid item has been established, no separate payment will be made for tree and plant protection specified herein. Include cost in price bid for related work items.

1.3 SUBMITTALS

A. Conform to requirements of Section 01 33 00 – Submittals.

B. Submit name and experience of qualified Arborist to Owner's Representative.

1.4 PROJECT CONDITIONS WHEN TREES AND PLANTS ARE IDENTIFIED TO REMAIN

A. Preserve and protect existing trees and plants from foliage, branch, trunk, or root damage that could result from construction operations when trees and plants are identified to remain.

B. Do not allow any vehicular traffic, construction equipment, parking of vehicles or stockpiling of excavated material or construction materials within protected tree

root zone areas. Refer to Section 1.6 DEFINITIONS, for Dripline/Root Zone Area definition.

C. Prevent the following types of damage:

1. Compaction of root zone area by equipment, vehicles, foot traffic or materials storage.
2. Suffocating roots by placing soil in excess of three inches (3") within root zone areas, including placement of any select fill or soil with high clay content.
3. Trunk and limb damage resulting from contact with equipment and vehicles.
4. Poisoning by pouring solvents, fuel, and other injurious materials on or near root zone areas or in areas where such materials will leak or wash into root zone areas.
5. Changing soil pH within root zones by depositing concrete, powdered lime or other materials used to stabilize or dehydrate soils.
6. Cutting roots measuring one inch (1") in diameter and larger within protected areas unless required for root pruning.
7. Scorching of foliage, twigs and limbs caused by direct contact with expulsion of hot exhaust from equipment or vehicles.
8. Branch damage due to improper pruning or trimming.
9. Damage from permanently altering drainage patterns near root zones.
10. Trunk and branch damage resulting from nailing or bolting.

1.5 DAMAGE ASSESSMENT

A. When trees other than those designated for removal are destroyed or badly damaged as result of construction operations, remove and replace with same size, species, and variety up to and including 8 inches in trunk diameter. Any tree larger than 8 inches in diameter shall be replaced with 8-inch diameter tree of same species and variety and total contract amount shall be reduced by amount determined from following International Shade Tree Conference formula: 0.7854 x D2 x $38.00 where D is diameter in inches of tree or shrub trunk measured 12 inches above grade.

1.6 DEFINITIONS

A. Dripline/Root Zone Area - The ground area delineated by the branch spread of a single plant or group of plants. This area is considered the most critical area

of roots and should be protected, excluding the area within the street located between curbs.

B. Zero Curb Cut - The process in which required street work is conducted without cutting or otherwise disturbing soil located immediately behind the existing curb.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Protection Fencing - Orange, plastic mesh fencing, four feet (4') in height with six feet (6') high steel T-bar posts. Set posts eighteen inches (18") into ground. Stretch fencing material taut prior to securing.

B. Fertilizer - A low salt, slow release fertilizer containing twenty-seven percent (27%) nitrogen, nine percent (9%) phosphorus and nine percent (9%) potassium (potash) or similar.

C. Plastic Vapor Barrier - Polyethylene sheeting at least 6-mil thickness and three feet width to prevent leaching of stabilized material into native soil.

D. Tree Replacements - Shall be as approved by Owner's Representative as necessary.

PART 3 - EXECUTION

3.1 PROTECTION AND MAINTENANCE OF EXISTING TREES AND SHRUBS

A. Except for trees shown on Drawings or determined by Owner's Representative to be removed or relocated, trees within Project area are to remain in place, protected from damage and maintained by Contractor.

B. If required by the Project specifications, employ a qualified Arborist. The Arborist must be approved by Owner's Representative and shall have a minimum of 5 (five) years of experience in the field of tree protection.

C. Perform the following services as required by construction activities for trees that remain:

1. Trimming

a. Trees shall be pruned in accordance ANSI A300 (Part 1) - 2001 Pruning Revision of ANSI A300-1995 Tree, Shrub and Other Woody Plant Maintenance - Standard Practices. Pruning shall be done by a

professional arborist who has received training in proper pruning techniques.

b. Pruning shall not alter the natural shape or character of the tree or leave holes in the canopy. Trees and shrubs should be pruned for balance as well as to maintain proper form and branching habit.

c. Cut limbs at branch collar. No stubs should remain on trees. Branch cuts should not gouge outer layer of tree structure or trunk.

2. Root Pruning

a. When excavating with equipment within the root zone area is unavoidable and roots cannot be preserved, root prune prior to excavation to minimize damage to the portion of the root system that will remain.

b. Prune roots using a conventional trenching machine. Trench along the proposed edge of excavation limits to a depth of three feet (3'). Do not allow ripping of roots with a backhoe or other equipment.

c. Following trenching with the machine, re-cut roots measuring one inch (1") in diameter and larger using appropriate sharpened, pruning shears or pruning saws to make a clean, smooth-cut surface. Cut roots flush with edge of soil to limit root exposure.

d. Backfill trench in a manner that will not allow settling using clean, native soil.

3. Fertilizing and Watering

a. Trees should be fertilized in accordance with the American National Standard for tree fertilization ANSI A300 (Part 2) - 1998 Tree, Shrub and Other Woody Plant Maintenance - Standard Practices (Fertilization).

b. Deep root fertilize all trees that have received disturbance or damage to their root zone area.

c. Fertilize entire root zone area within the dripline of the tree and continue ten feet (10') beyond the dripline.

d. Mixture shall be injected into the top ten inches (10") of soil, under pressure of one hundred and fifty pounds per square inch (150 psi) to two

hundred pounds per square inch (200 psi). Mix and apply per product label instructions.

e. Inject one-half gallon (1/2) of solution at a depth of ten inches (10") on spacing of three feet (3') between injection points.

f. Fertilizer shall be mixed in a tank with mechanical agitation.

g. Fertilizer to be added to tank and mixed on site.

h. During periods of inadequate rainfall, water trees once weekly to saturate soil to a depth of six inches (6") to eight inches (8") within root zones. Allow soils to dry between watering. Do not allow soils to remain wet.

4. Water areas currently being served by private sprinkler systems to maintain health of existing landscapes if the affected systems are temporarily taken out of service due to construction activities.

5. Contractor's option with Owner's Representative's permission, shrubs to remain may be temporarily transplanted and returned to original positions under supervision of professional horticulturist.

3.2 PROTECTION

A. Construction Methods

1. General

a. Contractor shall attend a pre-construction meeting conducted by the Owner's Representative to review tree preservation requirements and sequence of services for the construction process.

b. Protect tree limbs, trunks and foliage from direct exposure to hot exhaust from equipment and vehicles by providing adequate exhaust pipe deflectors.

c. Cover exposed roots within 24 hours to reduce damage caused by desiccation. Roots may be covered with soil or mulch to help protect them from drying.

d. Protect root zone areas from damage that may result from soil compaction or from noxious materials in solution caused by run-off or

spillage during mixing and placement of construction materials, or drainage from stored materials.

e. Minimize cut to two inches (2") below grade when installing silt fence within tree root zones or anchor base of fabric on grade using gravel or staples. Do not cut roots 1" in diameter or larger.

f. Site preparation work and/or construction work shall not begin in any area where tree preservation measures have not been completed and approved by the Owner's Representative.

2. Preparation

a. Contractor shall not allow any vehicular traffic, parking of vehicles or stockpiling of excavated material or construction material within the root zone area of trees to be preserved.

b. When access within protected root zone areas by equipment traffic or frequent foot traffic cannot be avoided, contact Owner's Representative for review prior to entrance. Place a three-quarter inch (3/4") thick layer of plywood on natural grade within root zones to minimize soil compaction. Overlap edges of plywood by six inches (6") to twelve inches (12") to ensure adequate coverage. This is not acceptable bridging for driving over exposed tree roots. Exposed roots should not be driven over.

c. Contractor shall notify Owner's Representative if existing tree locations differ from locations represented on construction drawings. The tree location and dripline/root zone area as observed in the field shall supersede that outlined on construction plans.

3. Tree Protection Fencing

a. Each tree located adjacent to proposed soil excavation shall be protected with a tree protection fence or as designated on the plans. Fence locations shall be approved by Owner's Representative.

b. Contractor shall not remove or relocate tree protection fencing and shall not operate within the limits shown without approval of the Owner's Representative.

c. Fences shall be placed in continuous alignment to protect a tree or group of trees.

d. Posts shall be installed on eight-foot (8') centers at eighteen inches (18") below grade. The fencing shall be continuous between posts, shall be

pulled taut prior to securing to posts, and shall be firmly attached to the posts with a minimum of three (3) wire ties.

e. Place fencing in a manner that will not obstruct traffic site lines at curbs, intersections or driveways.

f. Fencing shall be removed only after all work within the immediate area is complete.

g. Contractor shall immediately repair fences if damage occurs at no additional charge to client.

4. Excavation within Root Zone Areas

   a. For excavation within root zone areas, where required for personal safety, provide excavation protection by using vertical-wall-shoring techniques at excavations to minimize excavation width. Do not bench cut or step cut edge where such techniques will encroach on root zone areas.

   b. If roots are encountered and must be severed, roots measuring one inch (1") in diameter and larger shall be cut using a sharpened pruning instrument to leave a smooth, clean-cut surface.

5. Zero Curb Cut and Vapor Barrier Installation

   a. Where existing curb is to be removed within tree root zone areas, do not disturb soil immediately back of curb. Do not allow forms and stakes to disturb roots.

   b. A vapor barrier shall be installed to provide a non-leaching barrier between any stabilized material and/or concrete and tree roots and soils.

   c. Vapor barrier shall be installed vertically to a depth of five inches (5") below limits of stabilized material. Vapor barrier to be extended ten inches (10") above natural grade and ten feet (10') beyond the dripline limits of the tree. Trim vertical vapor barrier to approximately one inch (1") above grade after installation of final grade.

6. Boring/Tunneling

   a. In areas indicated, bore under root systems of trees at a minimum depth of four feet (4') from the top of pipe to the soil surface at natural grade.

   b. Bore pits and receiving pits shall be located outside of protected root zone areas.

   c. Equipment and material shall be positioned outside of protected root zone areas. When access within protected root zone area by equipment traffic or frequent foot traffic cannot be avoided, place a three-quarter inch (3/4")

thick layer of plywood on natural grade within root zones to minimize soil compaction, refer to Section 3. 2, A, 2.

7. Trunk Barricading
   a. Install trunk barricading to protect trees in close proximity of moving or mechanical equipment and construction work when work is required within the tree protection fencing as shown on the plans.
   b. Place trunk barricading around entire tree trunks to protect tree trunks located within five feet (5') of construction activities.
   c. Install 2x4's or 2x6's (5-foot to 6-foot lengths) spaced 3 inches (3") apart around the circumference of the tree trunk.
   d. Tie in place with 9 to 12 gauge steel wire.

B. Sequence of Tree Protection and Services
   1. Fertilize trees affected by construction between the months of October and May.
   2. Prune/trim trees for clearance and safety.
   3. Root Prune trees.
   4. Place tree protection fence and trunk barricades to protect trees. Place fencing prior to any construction activities.
   5. Remove tree protection upon completion of project.

C. Existing Stressed and Declining Trees
   1. Prior to beginning the construction phase, trees located within the right-of-way should be reviewed and trees that appear to be stressed or declining in health should be documented. Immediately notify the Owner's Representative of any dead and dying trees.

D. Accidental Spills of Toxic Materials
   1. Concrete, lime or other chemicals placed or accidentally spilled within root zone protection areas shall be completely removed. Contaminated soil shall be completely removed at the time of the spill and removed by hand shovel. Fresh soil shall be added as necessary to bring the soil level to that of natural grade.

3.3 MAINTENANCE OF NEWLY PLANTED TREES AND REPLANTED TREES

A. Show proof of capacity to water during dry periods.

B. Guarantee trees planted for this Project shall remain alive and healthy at least until end of 1-year warranty period.
   1. Within 4 weeks notice from Owner's Representative, replace dead trees or trees that in opinion of Owner's Representative have become unhealthy,

unsightly or have lost their natural shape as result of additional growth, improper pruning, maintenance or weather conditions.

2. When tree must be replaced, guarantee period begins on date of tree replacement, subject to Owner's Representative's inspection, for no less than 1 year.
3. Straighten leaning trees and bear entire cost.
4. Dispose of trees rejected by Owner's Representative and bear entire cost.

END OF SECTION

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SECTION 01 71 32.16

CONSTRUCTION SURVEYING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for construction surveying.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.

1.2 QUALITY CONTROL

A. Conform to State of Texas laws for surveys requiring licensed surveyors.

B. Employ land surveyor acceptable to the Owner, if required.

1.3 MEASUREMENT AND PAYMENT

A. No Separate payment will be made for field surveying. Include cost in unit price for Work requiring field surveying.

1.4 SUBMITTALS

A. Conform to requirements of Section 01 33 00 – Submittals.

B. Submit to Owner's Representative name, address, and telephone number of Surveyor before starting survey work.

C. Submit documentation verifying accuracy of survey work on request.

D. Submit certificate signed by surveyor, that elevations and locations of Work are in conformance with Contract.

1.5 PROJECT RECORD DOCUMENTS

A. Maintain complete and accurate log of control and survey Work as it progresses.

B. Prepare certified survey setting forth dimensions, locations, angles, and elevations of construction and site Work upon completion of foundation walls and major site improvements.

1.6 EXAMINATION

A. Verify locations of survey control points prior to starting Work.

B. Notify Owner's Representative immediately of any discrepancies discovered.

1.7 SURVEY REFERENCE POINTS

A. Control datum for survey established by provided survey as indicated on Contract Drawings. Inform Owner's Representative in advance of time at which horizontal and vertical control points will be established so verification deemed necessary by Owner's Representative may be done with minimum inconvenience to Owner's Representative and minimum delay to Contractor.

B. Locate and protect survey control points prior to starting site work; preserve permanent reference points during construction.

C. Notify Owner's Representative 48 hours in advance of need for relocation of reference points due to changes in grades or other reasons.

D. Report promptly to Owner's Representative loss or destruction of reference point.

E. Contractor to replace permanent reference points disturbed by operations, at no additional cost to the Owner.

1.8 SURVEY REQUIREMENTS

A. Utilize recognized engineering survey practices.

B. Establish minimum of two permanent bench marks on site, referenced to established control points. Record locations with horizontal and vertical data on Project Record Documents.

C. Establish elevations, lines, and levels to provide quantities required for measurement and payment and to provide appropriate controls for Work. Locate and lay out by instrumentation and similar appropriate means:

1. Site improvements including pavements; stakes for grading; fill and topsoil placement; utility locations, slopes, and invert elevations
2. Grid or axis for structures
3. Building foundation, column locations, ground floor elevations

D. Periodically verify layouts by same means.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 74 13

CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes intermediate and final cleaning of Work, not including special cleaning of closed systems specified elsewhere.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

1.3 SUBMITTALS (NOT USED)

1.4 STORAGE AND HANDLING

A. Store cleaning products and cleaning wastes in containers specifically designed for those materials.

1.5 SCHEDULING

A. Schedule cleaning operations so that dust and other contaminants disturbed by cleaning process will not fall on newly painted surfaces.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents:

1. Compatible with surface being cleaned.
2. New and uncontaminated.
3. For Manufactured Surfaces: Material recommended by manufacturer.

PART 3 - EXECUTION

3.1 CLEANING - GENERAL

A. Prevent accumulation of wastes that create hazardous conditions.

B. Conduct cleaning and disposal operations to comply with laws and safety orders of governing authorities.

C. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains or sewers.

D. Dispose of degradable debris at an approved solid waste disposal site.

E. Dispose of nondegradable debris at an approved solid waste disposal site or in an alternate manner approved by regulatory agencies.

F. Handle materials in a controlled manner with as few handlings as possible.

G. Do not drop or throw materials from heights greater than 4 FT or less than 4 FT if conditions warrant greater care.

H. On completion of work, leave area in a clean, natural looking condition.

1. Remove all signs of temporary construction and activities incidental to construction of required permanent Work.

I. Do not burn on-site.

3.2 INTERIOR CLEANING

A. Cleaning During Construction:

1. Keep work areas clean so as not to hinder health, safety or convenience of personnel in existing facility operations.
2. At maximum weekly intervals, dispose of waste materials, debris, and rubbish.
3. Vacuum clean interior areas when ready to receive finish painting.
   a. Continue vacuum cleaning on an as-needed basis, until Substantial Completion.

B. Final Cleaning:

1. Complete immediately prior to Demonstration Period.
2. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from sight-exposed surfaces.
3. Wipe all lighting fixture reflectors, lenses, lamps and trims clean.
4. Wash and shine glazing and mirrors.
5. Polish glossy surfaces to a clear shine.
6. Ventilating systems:
   a. Clean permanent filters and replace disposable filters if units were operated during construction.

b. Clean ducts, blowers and coils if units were operated without filters during construction.

7. Replace all burned out lamps.
8. Broom clean process area floors.
9. Mop office and control room floors.

3.3 EXTERIOR (SITE) CLEANING

A. Cleaning During Construction:

1. Construction debris:
   a. Confine in strategically located container(s):
      1) Cover to prevent blowing by wind.
      2) Store debris away from construction or operational activities.
      3) Haul from site minimum once a week.
   b. Remove from work area to container daily.
   c. Site clean-up prior to storm events. Thoroughly clean site of all loose or unsecured items which may become airborne or transported by flowing water during storm events.
2. Vegetation: Keep weeds and other vegetation trimmed to 3 IN maximum height.
   a. The use of chemical weed control substances should be avoided unless prior Owner approval is received.
3. Soils, sand, and gravel deposited on paved areas and walks:
   a. Remove as required to prevent muddy or dusty conditions.
   b. Do not flush into storm sewer system.

B. Final Cleaning:

1. Remove trash and debris containers from site.
   a. Repair areas disturbed by location of trash and debris containers to Owner’s satisfaction including but not limited to re-seeding, sod

placement, pavement repair, asphalt repair, sidewalk repair, and rut removal and/or fill placement.

2. Clean paved roadways.

3.4 FIELD QUALITY CONTROL

A. Immediately prior to Demonstration Period, conduct an inspection with Owner's Representative to verify condition of all work areas.

END OF SECTION

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SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for construction waste management and disposal.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.

2. Division 01 – General Requirements.

1.2 MEASUREMENT AND PAYMENT

A. No separate payment will be made for waste material disposal under this Section. Include payment in unit price for related sections.

1.3 SUBMITTALS

A. Conform to requirements of Section 01 33 00 – Submittals.

B. Obtain and submit disposal permits for proposed disposal sites if required by local ordinances. Submit a copy of all disposal permits to the Owner's Representative.

C. Submit copy of written permission from property owner(s) outside limits of Project, with description of property, prior to disposal of excess material. Submit written and signed release from property owner upon completion of

disposal work. Copies of the permission and release documents are to be submitted to the Owner's Representative.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SALVAGEABLE MATERIAL

A. Excavated Material: When indicated on Drawings, load, haul, and deposit excavated material at location or locations shown on Drawings outside limits of Project.

B. Other Salvageable Materials: Conform to requirements of individual Specification Sections.

C. Coordinate with the Owner's Representative the loading of salvageable material.

3.2 EXCESS MATERIAL

A. Remove and legally dispose of vegetation, rubble, broken concrete, debris, asphaltic concrete pavement, excess soil, and other materials not designated for salvage from job site.

B. Excess soil may be deposited on private property outside the Project limits when written permission is obtained from property owner. See Paragraph 1.3C above.

C. Verify flood plain status of any proposed disposal site. Do not dispose of excavated materials in area designated as within 100-year Flood Hazard Area unless the proper permit has been obtained. Remove excess material placed in "100-year Flood Hazard Area" at no additional cost to the Owner.

D. Remove waste materials from site daily, in order to maintain site in neat and orderly condition, unless otherwise authorized by the Owner.

END OF SECTION

SECTION 03 31 30

CONCRETE, MATERIALS AND PROPORTIONING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete materials, strengths and proportioning for concrete work.
2. Grouting:
   a. Base plates for columns and equipment.
   b. Dowels and anchors into concrete.
   c. Patching cavities in concrete.
   d. As specified and indicated in the Contract Document.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Section 03 05 05 – Testing.
4. Section 31 23 23.33 – Flowable Fill.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. American Concrete Institute (ACI):
   a. 116R – Cement and Concrete Terminology.
   b. 211.1 – Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
   c. 212.3R – Chemical Admixtures for Concrete.
   d. 318 – Building Code Requirements for Structural Concrete.
   e. 350 – Code Requirements for Environmental Engineering Concrete Structures.
2. ASTM International (ASTM):
   a. C33 – Standard Specification for Concrete Aggregates.

b. C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

c. C94 – Standard Specification for Ready-Mixed Concrete.

d. C150 – Standard Specification for Portland Cement.

e. C157 – Standard Test Method for Length Change of Hardened Hydraulic-Cement, Mortar, and Concrete.

f. C192 – Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.

g. C260 – Standard Specification for Air-Entraining Admixtures for Concrete.

h. C494 – Standard Specification for Chemical Admixtures for Concrete.

i. C618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

3. Corps of Engineers (USACE):

a. CRD-C621 – Standard Specification for Packaged, Dry, Hydraulic-Cement Grout (NonShrink).

1.4 DEFINITIONS

A. Words and terms used in these Specifications are defined in ACI 116R.

1.5 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.

2. Product technical data including:

a. Acknowledgement that products submitted meet requirements of standards referenced.

b. Manufacturer's instructions.

c. Concrete mix designs as required by Specification Section 03 05 05.

d. Manufacturer and type of proposed admixtures.

e. Manufacturer and type of proposed non-shrink grout and grout cure/seal compound.

3. Certifications:

a. Certification of standard deviation value in psi for ready mix plant supplying the concrete.

b. Certification that the fly ash meets the quality requirements stated in this Specification Section, and fly ash supplier's certified test reports for each shipment of fly ash delivered to concrete supplier.

c. Certification that the class of coarse aggregate meets the requirements of ASTM C33 for type and location of concrete construction.

d. Certification of aggregate gradation.

4. Test reports: Cement mill reports for all cement to be supplied.

1.6 DELIVERY, STORAGE AND HANDLING

A. Storage of Materials:

1. Store cement and pozzolan in weathertight buildings, bins, or silos which will exclude moisture and contaminants.
2. Arrange aggregate stockpiles and use in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of like aggregates.
3. Allow natural sand to drain until it has reached a relatively uniform moisture content before use.
4. Store admixtures in such a manner as to avoid contamination, evaporation, or damage.

a. For those used in form of suspensions or non-stable solutions, provide agitating equipment to assure thorough distribution of ingredients.

b. Protect liquid admixtures from freezing and temperature changes which would adversely affect their characteristics and performance.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cement:

1. ASTM C150, Type I/II.
2. Cement type used shall correspond to that upon which selection of concrete proportions was based in the mix design.

B. Fly Ash:

1. ASTM C618, Class F or Class C.
2. Non-staining.
3. Suited to provide hardened concrete of uniform light gray color.
4. Maximum loss on ignition: 4 percent.
5. Compatible with other concrete ingredients and having no deleterious effects on the hardened concrete.
6. Produced by source approved by the governing jurisdiction where the Project is located for use in concrete for bridges.

7. Cement and fly ash type used shall correspond to that upon which selection of concrete proportions was based in the mix design.

C. Admixtures:

1. Air entraining: ASTM C260.
2. Water reducing, retarding, and accelerating: Conform to ASTM C494, Types A through E, and provisions of ACI 212.3R.
3. High range water reducers (superplasticizers): Conform to ASTM C494, Types F or G.
4. Admixtures to be chloride free.
   a. Do not use calcium chloride.
5. Provide admixtures of same type, manufacturer and quantity as used in establishing required concrete proportions in the mix design.

D. Water:

1. Potable.
2. Clean and free from deleterious substances.
3. Free of oils, acids and organic matter.

E. Aggregates for Normal Weight Concrete:

1. ASTM C33.
2. Fine and coarse aggregates to be regarded as separate ingredients.
3. Fine aggregates to be natural, not manufactured.
4. Coarse aggregate sieve analysis:
   a. For lean concrete, concrete topping, and integral wearing course: ASTM C33, size number 7 (maximum 1/2 IN).
   b. For all other concrete: ASTM C33, size number 57 (maximum 1 IN) {or size number 67 (maximum 3/4 IN)}.
5. Provide aggregates approved for bridge construction by the governing jurisdiction where the Project is located.
6. Pozzolan or other additives shall not be used to compensate for alkali reactivity of aggregates.

F. Maximum total chloride ion content for concrete mix including all ingredients measured as a weight percent of cement:

1. Prestressed concrete: 0.06.
2. All other concrete: 0.10.

G. Sand Cement Grout:

1. Approximately three (3) parts sand, one (1) part Portland cement, 6 ±1 percent entrained air and water to produce a slump which allows grout to completely fill required areas and surround adjacent reinforcing.
    a. Provide sand in accordance with requirements for fine aggregate for concrete.
2. Minimum 28 day compressive strength: 3000 psi.

H. Non-shrink Grout:

1. Non-shrink, non-metallic, non-corrosive, and non-staining.
2. Premixed with only water to be added in accordance with manufacturer's instructions at jobsite.
3. Grout to produce a positive but controlled expansion.
    a. Mass expansion shall not be created by gas liberation or by other means.
4. Minimum 28 day compressive strength: 6500 psi.
5. Acceptable manufacturers:
    a. BASF Admixtures, Inc. "Masterflow, 713 Plus".
    b. Euclid Chemical "NS Grout".
    c. Sauereisen Cements "F-100 Level Fill Grout".
    d. U. S. Grout "Five Star Grout".
    e. Set Products, Inc. "Set Non-Shrink Grout".
    f. The Upco Corp "Upcon".
    g. L&M "Crystex".
    h. Sika Corporation "Sika Grout 212".
6. In accordance with COE CRD-C621.

I. Epoxy Grout:

1. Three-component epoxy resin system:
    a. Two (2) liquid epoxy components.
    b. One (1) inert aggregate filler component.
2. Adhesive acceptable manufacturers:
    a. BASF “Masterflow 648 CP”.
    b. Exxon Chemical Company "Escoweld 2505."
    c. Sika "Sikadur Hi-Mod."
    d. U. S. Grout "Five Start Epoxy Grout."
    e. Euclid Chemical "E3-G."

3. Aggregate acceptable manufacturers:
   a. BASF “Masterflow 648 CP”.
   b. Exxon Chemical Company "Escoweld 2510."
   c. Sika aggregate.
   d. U. S. Grout aggregate.
   e. Euclid Chemical "Euclid aggregate."
4. Aggregate manufacturer shall be the same as the adhesive manufacturer.
5. The aggregate shall be compatible with the adhesive.
6. Each component furnished in separate package for mixing at jobsite.
7. Submit request for substitution in accordance with Specification Section 01 25 13 – Product Substitutions.

2.2 MIXES

A. General:
   1. Provide concrete capable of being placed without aggregate segregation and, when cured, of developing all properties specified.
   2. Ready-mixed concrete shall conform to ASTM C94.
   3. All concrete to be normal weight concrete, weighing approximately 145 to 150 LBS per cubic foot at 28 days after placement.

B. Minimum 28 Day Compressive Strengths:

Normal weight concrete fill	3000 psi
Normal weight lean concrete	1500 psi
Normal weight concrete topping	4000 psi
Normal weight concrete	4000 psi
Normal weight precast concrete	5000 psi
Normal weight concrete pavements	4000 psi
Normal weight concrete integral wearing course	6000 psi

C. Air Entrainment:
   1. Provide air entrainment in all concrete resulting in a total air content percent by volume as indicated by ACI 318-08, Chapter 4:
      a. Exposure Class: S1.

b. Do not air entrain and maximum entrapped air shall not exceed 3 percent total air content for the following:

1) Interior slabs

2) Slabs with a steel trowel finish.

3) Slabs on composite metal decks.

D. Slump:

1. General: 4 IN maximum (+/- 1 IN) minimum measured at point of discharge into the concrete construction member.

a. Walls, beams, and columns: Provide high range water reducer (HRWR) and slump shall be 8 IN maximum (+/- 1 IN).

b. Provide HRWR as required for placement.

c. Do not provide HRWR in slab and pavements.

2. Concrete of lower than minimum slump may be used provided it can be properly placed and consolidated.

3. Provide additional water or water reducing admixture at ready mix plant for concrete that is to be pumped to allow for slump loss due to pumping.

a. Provide only enough additional water so that slump of concrete at discharge end of pump hose does not exceed maximum slump specified and the maximum specified water-cement ratio is not exceeded.

4. Slump may be adjusted in the field through the use of water reducers.

a. Coordinate dosage and mixing requirements with concrete supplier.

E. Proportioning:

1. General:

a. Proportion ingredients to produce a mixture which will work readily into corners and angles of forms and around reinforcement by methods of placement and consolidation employed without permitting materials to segregate or excessive free water to collect on surface.

b. Proportion ingredients to produce proper placability, durability, strength and other required properties.

2. Normal weight concrete minimum cement contents and maximum water cement ratios:

SPECIFIED STRENGTH (PSI)	MINIMUM CEMENT (LBS/CY)	MAXIMUM WATER CEMENT RATIO BY WEIGHT
3000	517*	0.45
4000	564*	0.45

4000 (Drilled Shaft)	658*	0.45
4500	611*	0.42
5000	611*	0.45
6000	658*	0.45

* If fly ash is proposed for use, the weight of fly ash plus weight of Portland cement shall equal these values.

3. Fly ash:
   a. For cast-in-place concrete only, a maximum of 25 percent by weight of Portland cement content per cubic yard may be replaced with fly ash at a rate of 1 LB fly ash for 1 LB cement.
   b. If fly ash is used, the water to fly ash plus cement ratio not to exceed the maximum water cement ratio specified in this Specification Section.
   c. Concrete containing fly ash shall not be used in the construction of the precast and prestressed concrete units.
4. Water reducing, retarding, and accelerating admixtures:
   a. Use in accordance with manufacturer's instructions.
   b. Do not use unless required by these specifications or approved for use by Owner’s Representative.
5. High range water reducers (superplasticizers):
   a. Use in accordance with manufacturer's instructions.
   b. Do not use unless required by these Specifications or approved for use by Owner’s Representative.
6. Concrete mix proportioning methods for normal weight concrete:
   a. Method 1:
      1) Used when combination of materials proposed is to be evaluated and proportions selected to be on a basis of trial mixes.
      2) Produce mixes having suitable proportions and consistencies based on ACI 211.1, using at least three (3) different water cement ratios or cement contents which will produce a range of compressive strengths encompassing the required average strength.
      3) Design trial mixes to produce a slump within 0.75 IN of maximum specified, and for air entrained concrete, air content within 0.5 percent specified.
      4) For each water cement ratio or cement content, make at least three (3) compression test cylinders for specified test age, and cure in accordance with ASTM C192.
         a) Test for strength at 28 days in accordance with ASTM C39.

5) From results of these tests, plot a curve showing relationship between water cement ratio or cement content and compressive strength.

6) From this curve select water cement ratio or cement content to be used to produce required average strength.

7) Use cement content and mixture proportions such that maximum water cement ratio is not exceeded when slump is maximum specified.

8) Base field control on maintenance of proper cement content, slump, air content and water cement ratio.

9) See paragraph hereafter for definition of required average strength.

b. Method 2:

1) In lieu of trial mixes, field test records for concrete made with similar ingredients may be used.

2) Use of proposed concrete mix proportions based on field test records subject to approval by Owner's Representative based on information contained in field test records and demonstrated ability to provide the required average strength.

3) Field test records to represent materials, proportions and conditions similar to those specified.

a) Changes in the materials, proportions and conditions within the test records shall have not been more restricted than those for the proposed concrete mix.

b) Field test records shall meet the requirements of ACI 350 Paragraph 5.3.1.

4) Required concrete proportions may be established by interpolation between the strengths and proportions of two (2) or more test records each of which meets the requirements of this Specification Section.

7. Required average strength to exceed the specified 28 day compressive strength by the amount determined or calculated in accordance with Paragraph 5.3 of ACI 350 using the standard deviation of the proposed concrete production facility as described in Paragraphs 5.3.1 and 2 of ACI 350.

a. Specifier: Indicate air dry unit weight of lightweight concrete to correspond to unit weights used in structural design.

b. Mixture shall contain no more than 30 percent fines.

c. Proportioning of mixture shall be sufficient to produce a minimum unconfined compressive strength of 50 psi at 7 days.

F. Allowable Shrinkage: 0.048 percent per ASTM C157.

2.3 SOURCE QUALITY CONTROL

A. To assure stockpiles are not contaminated or materials are segregated, perform any test for determining conformance to requirements for cleanness and grading on samples secured from aggregates at point of batching.

B. Do not use frozen or partially frozen aggregates.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Perform concrete tests per Specification Section 03 05 05 – Testing.

B. Perform strength test on any concrete to which water has been added at the jobsite.

3.2 OWNER TRAINING (NOT USED)

END OF SECTION

SECTION 03 31 31

CONCRETE MIXING, PLACING, JOINTING, AND CURING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mixing, placing, jointing, and curing of concrete construction.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Section 03 31 30 – Concrete, Materials and Proportioning.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. American Concrete Institute (ACI):
   a. 116R – Cement and Concrete Terminology.
   b. 304R – Guide for Measuring, Mixing, Transporting and Placing Concrete.
   c. 304.2R – Placing Concrete by Pumping Methods.
   d. 305R – Hot Weather Concreting.
   e. 306R – Cold Weather Concreting.
   f. 308 – Standard Practice for Curing Concrete.
   g. 309R – Guide for Consolidation of Concrete.
2. ASTM International (ASTM):
   a. C94 – Standard Specification for Ready-Mixed Concrete.
   b. C156 – Standard Test Method for Water Loss (from a Mortar Specimen) Through Liquid Membrane-Forming Curing Compounds for Concrete.
   c. C171 – Standard Specification for Sheet Materials for Curing Concrete.
   d. C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

e. D994 – Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).

f. D1056 – Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.

g. D1751,Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

3. Corps of Engineers (USACE):

a. CRD-C572, Specifications for Polyvinylchloride Waterstops.

4. National Ready Mixed Concrete Association (NRMCA):

a. Checklist for Certification of Ready Mixed Concrete Production Facilities.

5. National Sanitation Foundation International (NSF).

B. Qualifications:

1. Ready Mixed Concrete Batch Plant: Certified by NRMCA.

1.4 DEFINITIONS

A. Words and terms used in this Specification Section are defined in ACI 116R.

1.5 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.

2. Product technical data including:

a. Acknowledgement that products submitted meet requirements of standards referenced.

b. Manufacturer's installation instructions.

1) Procedure for adding high-range water reducer at the jobsite.

c. Scaled (minimum 1/8 IN per foot) drawings showing proposed locations of construction joints and joint keyway dimensions.

d. Manufacturers and types:

1) Joint fillers.

2) Curing agents.

3) Construction joint bonding adhesive.

4) Pressure relief valves.

5) Waterstops.

3. Certifications:

a. Ready mix concrete plant certification.

b. Waterstops: Products shipped meet or exceed the physical properties specified.

B. Operation and Maintenance Manuals:

1. See Specification Section 01 33 00 – Submittals for requirements for:

a. The mechanics and administration of the submittal process.

b. The content of Operation and Maintenance Manuals.

C. Miscellaneous Submittals:

1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.

2. Copies of concrete delivery tickets.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery:

1. Concrete:

a. Prepare a delivery ticket for each load of ready mixed concrete.

b. Truck operator shall hand ticket to Contractor at the time of delivery.

c. Ticket to show:

1) Mix identification.

2) Quantity delivered.

3) Amount of material in each batch.

4) Outdoor temperature in the shade.

5) Time at which cement was added

6) Time of delivery.

7) Time of discharge.

8) Amount of water that may be added at the site without exceeding the specified water-cement ratio.

9) Amount of water added at the site.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Neoprene Expansion Joint Fillers:

1. Acceptable manufacturers:

a. Permaglaze.

b. Rubatex.

c. Williams Products.

2. Materials:

a. Closed cell neoprene.

b. ASTM D1056, Class SC.

c. Compression deflection: As required to limit deflection to 50 percent of joint thickness under pressure from concrete pour height.

B. Asphalt Expansion Joint Fillers:

1. Acceptable manufacturers:

a. W R Meadows.

b. J and P Petroleum Products.

2. Materials: ASTM D994.

C. Fiber Expansion Joint Fillers:

1. Materials: ASTM D1751.

D. Waterstops, PVC Type:

1. Acceptable manufacturers:

a. Greenstreak Plastic Products.

b. W R Meadows.

c. Paul Murphy Plastics.

2. Materials:

a. Virgin polyvinyl chloride compound not containing any scrap or reclaimed materials or pigment.

b. Standard: COE CRD-C572.

3. In expansion joints:

a. 6 IN or 9 IN wide by 3/8 IN thick tear web type waterstop as indicated in drawings.

b. 2 IN minimum horizontal movement without rupturing.

c. Greenstreak Plastic Products Style #700.

d. Greenstreak Plastic Products Style #701 and #705.

4. In control joints:

a. 6 IN wide by 3/8 IN thick with ribs and center bulb.

b. Greenstreak Plastic Products Style #705.

5. In all other joints:

a. 6 IN wide by 3/8 IN thick with ribs.

b. Greenstreak Plastic Products Style #705, #679 or #783.

6. Provide hog rings or grommets at maximum 12 IN OC along the length of the waterstop.
7. Provide factory-made waterstop fabrications at all changes in direction, intersections and transitions, leaving only straight butt splices for the field.

E. Waterstops, Preformed Strip Type:

1. Acceptable manufacturers:
   a. Hydrotite CJ by Greenstreak Plastics, Inc.
   b. Adeka Ultra Seal USA.
2. Materials:
   a. Hydrophilic type waterstop manufactured solely for the purpose of preventing water from traveling through construction joints.
   b. Hydrotite type CJ-0725-3K.

F. Submit request for substitution in accordance with Specification Section 01 25 13 – Product Substitutions.

PART 3 - EXECUTION

3.1 PREPARATION

A. General:

1. Complete formwork.
   a. See Specification Section 03 11 13 – Formwork.
2. Remove earth, snow, ice, water, and other foreign materials from areas that will receive concrete.
3. Secure reinforcement in place.
   a. See Specification Section 03 21 00 – Reinforcement.
4. Position expansion joint material, anchors and other embedded items.
5. Obtain approval of reinforcement erection and placement prior to placing concrete.
6. Do not place concrete during rain, sleet, or snow, unless adequate protection is provided and approval is obtained.
   a. Plan size of crews with due regard for effects of concrete temperature and atmospheric conditions on rate of hardening of concrete as required to obtain good surfaces and avoid unplanned cold joints.
   b. Do not allow rainwater to increase mixing water nor to damage surface finish.

7. Prepare all construction joints for proper bond per the Article JOINTS AND EMBEDDED ITEMS, paragraph Construction Joints - Bonding of this Specification Section.
8. Remove hardened concrete and foreign materials from inner surfaces of conveying equipment and formwork.
9. Provide slabs and beams of minimum indicated required depth when sloping structural foundation base slabs and elevated slabs to drains.
    a. For floor slabs on grade, slope top of subgrade to provide slab of required uniform thickness.

B. Preparation of Subgrade for Slabs On Ground:
1. Subgrade drained and of adequate and uniform load-bearing nature.
2. Obtain approval of subgrade compaction density prior to placing slabs on ground.
3. Maintain subgrade at a temperature above 32 DegF before concrete placing begins for a sufficient amount of time to remove frost.
4. Moisten subgrade to eliminate absorption.
    a. Keep subgrade moist at time of concreting.
    b. Allow no free-standing water on subgrade or soft or muddy spots when concrete is placed.

C. Edge Forms and Screeds:
1. Set accurately to produce designated elevations and contours of finished surface.
2. Sufficiently strong to support vibrating screeds or roller pipe screeds, if required.
3. Use strike off templates, or approved vibrating type screeds, to align concrete surfaces to contours of screed strips.

3.2 CONCRETE MIXING

A. General:
1. Provide all concrete from a central or dry mixed plant conforming to Checklist for Certification of Ready Mixed Concrete Production Facilities of the NRMCA.
2. Batch, mix, and transport in accordance with ASTM C94.
3. Time limit for discharging concrete from mixer trucks:
    a. Agitated:
        1) 90 minutes below 75 DegF.
        2) 60 minutes at or above 75 DegF and up to 90 DegF.

3) A set-retarder may be used to extend delivery time by 30 minutes.

b. Non-Agitated:

1) 30 minutes below 80 DegF

2) 15 minutes at or above 80 DegF

B. Control of Admixtures:

1. Charge admixtures into mixer as solutions.
   a. Measure by means of an approved mechanical dispensing device.
   b. Liquid considered a part of mixing water.
   c. Admixtures that cannot be added in solution may be weighed or measured by volume if so recommended by manufacturer.
2. Add separately, when two or more admixtures are used in concrete, to avoid possible interaction that might interfere with efficiency of either admixture, or adversely affect concrete.
3. Complete addition of retarding admixtures within one minute after addition of water to cement has been completed, or prior to beginning of last three quarters of required mixing, whichever occurs first.

C. Tempering and Control of Mixing Water:

1. Mix concrete only in quantities for immediate use.
2. Discard concrete which has set.
3. Discharge concrete from ready mix trucks within time limit and drum revolutions stated in ASTM C94.
4. Addition of water at the jobsite:
   a. See Specification Section 03 31 30 – Concrete, Materials and Proportioning for specified water cement ratio and slump.
   b. Do not exceed maximum specified water cement ratio or slump.
   c. Incorporate water by additional mixing equal to at least half of total mixing required.
   d. Perform strength test on any concrete to which water has been added at the jobsite.
      1) See Specification Section 03 05 05 – Testing for testing requirements.

3.3 PLACING OF CONCRETE

A. General:

1. Comply with ACI 304R and ACI 304.2R.
2. Deposit concrete:
   a. Continuously to avoid cold joints.

b. In layers of 12 to 18 IN.

3. Locate construction joints at locations approved by Owner's representative.
   a. Plan size of crews with due regard for effects of concrete temperature and atmosphere conditions to avoid unplanned cold joints.
4. Place concrete at such a rate that concrete, which is being integrated with fresh concrete, is still workable.
5. Do not deposit concrete which has partially hardened or has been contaminated by foreign materials.
6. Spreaders:
   a. Temporary: Remove as soon as concrete placing renders their function unnecessary.
   b. Embedded:
      1) Obtain approval of Owner's representative.
      2) Materials: Concrete or metal.
      3) Ends of metal spreaders coated with plastic coating 2 IN from each end.
7. Do not begin placing of concrete in supported elements until concrete previously placed in supporting members is no longer plastic and has been in place at least a minimum of 2 HRS.
8. Deposit concrete as nearly as practicable in its final position to avoid segregation.
   a. Maximum free fall: 5 FT without high range water reducer. 10 FT with high range water reducer.
   b. Drilled shafts place in the dry do not have a free fall restriction.
   c. Free fall exceeding limits specified: Place concrete by means of hopper, elephant trunk or tremie pipe extending down to within 1 FT of surface placed upon.
9. Perform the following operations before bleeding water has an opportunity to collect on surface:
   a. Spread.
   b. Consolidate.
   c. Straightedge.
   d. Darby or bull float.

B. Admixtures:
   1. All admixtures to be introduced at the batch plant in accordance with manufacturer's recommendations.

C. Cold Weather Concrete Placement:

1. Comply with ACI 306R.
2. Do not place concrete on substrates that are below 32 DegF or contain frozen material.
3. Maintain all materials, forms, reinforcement, subgrade and any other items which concrete will come in contact with free of frost, ice or snow at time of concrete placement.
4. Temperature of concrete when discharged at site:

AIR TEMPERATURE DEGF	MINIMUM CONCRETE TEMPERATURE, DEGF FOR SECTIONS WITH LEAST DIMENSION LESS THAN 12 IN	MINIMUM CONCRETE TEMPERATURE, DEGF FOR SECTIONS WITH LEAST DIMENSION 12 IN OR GREATER
30 to 45	60	55
0 to 30	65	55
below 0	70	60

5. Heat subgrade, forms, and reinforcement so the temperature of the subgrade, forms, and reinforcement will be between 45 and 70 DegF, when temperature of surrounding air is 40 DegF or below at time concrete is placed.
   a. Remove all frost from subgrade, forms and reinforcement before concrete is placed.
6. Combine water with aggregate in mixer before cement is added, if water or aggregate is heated above 90 DegF.
7. Do not mix cement with water or with mixtures of water and aggregate having a temperature greater than 90 DegF.
8. Do not place slabs on ground if temperature is below 40 DegF or if temperature surrounding the slab will be below 40 DegF before structure is enclosed and heated.

D. Hot Weather Concrete Placement:

1. Comply with ACI 305R.
2. Cool ingredients before mixing, or add flake ice or well crushed ice of a size that will melt completely during mixing for all or part of mixing water if high temperature, low slump, flash set, cold joints, or shrinkage cracks are encountered.
3. Temperature of concrete when placed:
   a. Not to exceed 90 DegF.

b. The maximum temperature of concrete shall not exceed 90 F at the time the concrete is placed. The temperatures of the mixing water shall be reduced by the use of chilled water or ice.

c. The maximum temperature of concrete with high range water reducing admixture shall not exceed 95 F at the time concrete is placed.

d. Under extreme heat, wind, or humidity conditions, concreting operations may be suspended if the quality of the concrete being placed is not acceptable.

e. Not so high as to cause:

1) Shrinkage cracks.

2) Difficulty in placement due to loss of slump.

3) Flash set.

4. Temperature of forms and reinforcing when placing concrete:

a. Not to exceed 90 DegF.

b. May be reduced by spraying with water to cool below 90 DegF.

1) Leave no standing water to contact concrete being placed.

E. Consolidating:

1. Consolidate in accordance with ACI 309R except as modified herein.

2. Consolidate by vibration so that concrete is thoroughly worked around reinforcement, embedded items and into corners of forms.

a. Eliminate:

1) Air or stone pockets.

2) Honeycombing or pitting.

3) Planes of weakness.

3. Internal vibrators:

a. Minimum frequency of 8000 vibrations per minute.

b. Insert and withdraw at points approximately 18 IN apart.

1) Allow sufficient duration at each insertion to consolidate concrete but not sufficient to cause segregation.

c. Use in:

1) Beams and girders of framed slabs.

2) Columns and walls.

d. Size of vibrators shall be in accordance with ACI 309R, Table 5.1.5.

4. Obtain consolidation of slabs with internal vibrators, vibrating screeds, roller pipe screeds, or other approved means.

5. Do not use vibrators to transport concrete within forms.
6. Provide spare vibrators on jobsite during all concrete placing operations.
7. Bring a full surface of mortar against form by vibration supplemented if necessary by spading to work coarse aggregate back from formed surface, where concrete is to have an as-cast finish.
8. Use suitable form vibrators located just below top surface of concrete, where internal vibrators cannot be used in areas of congested reinforcing.
9. Prevent construction equipment, construction operations, and personnel from introducing vibrations into freshly placed concrete after the concrete has been placed and consolidated.

F. Handle concrete from mixer to place of final deposit by methods which will prevent segregation or loss of ingredients and in a manner which will assure that required quality of concrete is maintained.
   1. The sum of time for transporting in agitating and non-agitating devices may not exceed the maximum agitated concrete time allowed.
   2. Use truck mixers, agitators, and non-agitating units in accordance with ASTM C94.
   3. Horizontal belt conveyors:
      a. Mount at a slope which will not cause segregation or loss of ingredients.
      b. Protect concrete against undue drying or rise in temperature.
      c. Use an arrangement at discharge end to prevent segregation.
      d. Do not allow mortar to adhere to return length of belt.
      e. Discharge conveyor runs into equipment specially designed for spreading concrete.
   4. Metal or metal lined chutes:
      a. Slope not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal.
      b. Chutes more than 20 FT long and chutes not meeting slope requirements may be used provided they discharge into a hopper before distribution.
      c. Provide end of each chute with a device to prevent segregation.
   5. Pumping or pneumatic conveying equipment:
      a. Designed for concrete application and having adequate pumping capacity.
      b. Control pneumatic placement so segregation is avoided in discharged concrete.
      c. Loss of slump in pumping or pneumatic conveying equipment shall not exceed 1-1/2 IN.

d. Do not convey concrete through pipe made of aluminum or aluminum alloy.

e. Provide pumping equipment without Y sections.

G. Placing of Concrete on Metal Deck:

1. Prior to concrete placement, the metal deck shall be free of soil, debris, standing water, loose mill scale, and all other foreign matter.
2. Care shall be exercised when placing concrete so that the deck will not be subject to construction loads or impact that exceed the design capacity of the deck.
3. Concrete shall be placed in a uniform manner and spread toward the center of the deck span.
4. If buggies are used to place concrete, runways shall be planked, and the buggies shall only operate on planking.
   a. Planks shall be of adequate stiffness to transfer loads to the steel supports without damaging the deck.
5. Deck damage caused by careless placement of concrete shall be repaired or replaced.

3.4 JOINTS AND EMBEDDED ITEMS

A. Construction Joints - General:

1. Locate joints as indicated on Contract Drawings or as shown on approved Shop Drawings.
   a. Where construction joint spacing shown on Drawings exceeds the joint spacing indicated in the Construction Joints - Spacing paragraph below, submit proposed construction joint location in conformance with this Specification Section.
2. Unplanned construction joints will not be allowed.
   a. If concrete cannot be completely placed between planned construction joints, then it must be removed.
3. In general, locate joints near middle of spans of slabs, beams and girders unless a beam intersects a girder at this point, in which case, offset joint in girder a distance equal to twice the width of the beam.
4. Locate joints in walls and columns at underside of floors, slabs, beams, or girders, and at tops of foundations or floor slabs, unless shown otherwise.
   a. At Contractor's option, beam pockets may be formed into concrete walls.
   b. Size pockets to allow beam reinforcing to be placed as detailed on Drawings.
5. Place beams, girders, column capitals and drop panels at same time as slabs.

6. Place corbels monolithically with walls.
   a. Locate wall vertical construction joints midway between corbels.
   b. Where only a single corbel is located place it also monolithically with wall and locate wall vertical construction joint a minimum of 3 FT from face of corbel.
7. Make joints perpendicular to main reinforcement with all reinforcement continuous across joints.
8. Provide roughened construction joints at all construction joints unless indicated otherwise on Drawings.
   a. Clean the previously hardened concrete interface and remove all laitance.
   b. Intentionally roughen the interface to a full amplitude of 1/4 IN.
   c. Provide recessed flat surface as required to install strip type waterstops.

B. Construction Joints - Spacing:
1. General - Structures not intended to contain liquid:
   a. Wall vertical construction joints, unless noted otherwise:
      1) 40 FT maximum centers.
      2) At wall intersections, 20 FT maximum from corner.
   b. Wall horizontal construction joints: 15 FT centers.
   c. Base slab, floor, and roof slab construction joints:
      1) Placements to be approximately square and not to exceed 3500 SF.
      2) Maximum side dimension of a slab pour to be less than:
         a) Twice the length of the short side.
         b) 80 FT.
2. Structures intended to contain liquids:
   a. Wall vertical construction joint, unless noted otherwise:
      1) 30 FT maximum centers.
      2) At wall intersections, 15 FT maximum from corner.
   b. Wall horizontal construction joints: 15 FT centers.
   c. Base slab, floor, and roof slab construction joints:
      1) Placements to be approximately square and not to exceed 2000 SF.
      2) Maximum side dimension of a slab pour to be less than:
         a) Twice the length of the short side.
         b) 60 FT.

C. Construction Joints - Bonding:

1. General: Obtain bond between concrete pours at construction joints by thoroughly cleaning and removing all laitance from construction joints.

   a. Before new concrete is placed, all construction joints shall be dampened and at a saturated, surface dry condition – surface moisture weakens the joint.

2. Roughened construction joints: All joints shall be roughened unless otherwise noted. Roughen the surface of the concrete to expose the aggregate uniformly, minimum 1/4" amplitude.

3. Keyed construction joints: Provide keyed joints where indicated on the Drawings.

D. Locate control joints in slabs on grade as indicated on Drawings.

1. Time cutting properly with set of concrete, if saw cut joints are required or permitted.

   a. Start cutting as soon as concrete has hardened sufficiently to prevent aggregates being dislodged by saw. Approximately 1 to 2 hours after finishing operations are completed.

   b. Complete before shrinkage stresses become sufficient to produce cracking.

E. Expansion Joints:

1. Do not permit reinforcement or other embedded metal items bonded to concrete (except smooth dowels bonded on only one side of joint) to extend continuously through an expansion joint.

2. Use neoprene expansion joint fillers, unless noted otherwise on Drawings.

3. Seal expansion joints as shown on Drawings.

   a. See Specification Section 07 92 00 – Joint Sealants for requirements.

F. Waterstops:

1. Preformed strip type:

   a. Install on smooth surface of hardened concrete by use of nails, adhesive or other means as recommended by manufacturer to prevent movement of waterstop during placement of concrete.

   b. Waterstop to be continuous with splices in accordance with manufacturer's instructions.

   c. Use in joints against existing concrete and where indicated on Drawings.

2. PVC type:

   a. Position waterstop accurately in forms.

   b. Secure waterstops in correct position using hog rings or grommets spaced along the length of waterstop and tie wire to adjacent reinforcing.

c. Hold horizontal waterstops in place with continuous supports.

d. Install according to manufacturer's instructions.

1) Do not displace reinforcement from required location.

e. Waterstops to be continuous.

f. Splice ends with perpendicular butt splice using electrical splicing iron in accordance with manufacturer's instructions.

g. Unless otherwise noted, use for all construction joints in new construction for all structures indicated on Drawings.

G. Other Embedded Items:

1. Place sleeves, inserts, anchors, and embedded items required for adjoining work or for its support, prior to initiating concreting.

2. Do not place electrical conduit, drains, or pipes in or thru concrete slabs, walls, columns, foundations, beams or other structural members unless approved by Owner’s representative.

H. Placing Embedded Items:

1. Position expansion joint material, waterstops, and other embedded items accurately.

2. Support against displacement.

3. Fill voids in sleeves, inserts and anchor slots temporarily with readily removable material to prevent entry of concrete into voids.

4. Provide adequate means for anchoring waterstop in concrete.

a. Provide means to prevent waterstops in the forms from being folded over by the concrete as it is placed.

b. Work concrete under the waterstops by hand, so as to avoid the formation of air and rock pockets, when placing roof and floor slab concrete around waterstops.

3.5 FINISHING

A. See Specification Section 03 31 32 – Concrete Finishing and Repair of Surface Defects.

B. Coordinate mixing and placing with finishing.

3.6 INSTALLATION OF GROUT

A. Grout Schedule of Use:

1. Sand cement grout:

a. Fill keyways if precast HCU.

b. General use.

2. Non-shrinking non-metallic grout:
    a. Filling form tie holes.
    b. Under column and beam base plates.
    c. Other uses indicated on the Drawings.
3. Epoxy grout:
    a. Patching cavities in concrete.
    b. Grouting of dowels and anchor bolts into existing concrete.
    c. Grouting of equipment base plates where driving motor is 500 HP and above.
    d. Other uses indicated on the Drawings.

B. Grout Installation:
1. Sand cement grout:
    a. Fill keyways between precast concrete hollow core slabs with sand cement grout.
    b. Consolidate grout by rodding or by other means to assure complete filling of keyways.
    c. Cure grout by one of methods specified.
2. Non-shrink non-metallic grout:
    a. Clean concrete surface to receive grout.
    b. Saturate concrete with water for 24 HRS prior to grouting.
    c. Mix in a mechanical mixer.
    d. Use no more water than necessary to produce flowable grout.
    e. Place in accordance with manufacturer's instructions.
    f. Provide under beam, column, and equipment base plates, in joints between precast concrete filter slabs, and in other locations indicated on the Drawings.
    g. Completely fill all spaces and cavities below the top of base plates.
    h. Provide forms where base plates and bed plates do not confine grout.
    i. Where exposed to view, finish grout edges smooth.
    j. Except where a slope is indicated on the Drawings, finish edges flush at the base plate, bed plate, member or piece of equipment.
    k. Coat exposed edges of grout with cure or seal compound recommended by the grout manufacturer.
3. Epoxy grout:
    a. Mix and place in accordance with manufacturer's instructions.

b. Apply only to clean, dry, sound surface.

c. Completely fill all cavities and spaces around dowels and anchors without voids.

d. Grout base and bed plates as specified for non-shrinking, non-metallic grout.

e. Obtain manufacturer's field technical assistance as required to assure proper placement.

3.7 CURING AND PROTECTION

A. Protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury immediately after placement, and maintain with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement, hardening, and compressive strength gain.

1. Follow recommendations of ACI 308 except as modified herein.

B. Unless noted otherwise, apply one of the following curing procedures immediately after completion of placement and finishing, for concrete surfaces not in contact with forms.

1. Ponding or continuous sprinkling.
2. Application of absorptive mats or fabric kept continuously wet.
3. Application of sand kept continuously wet.
4. Continuous application of steam (not exceeding 150 DegF) or mist spray.
5. Application of waterproof sheet materials, conforming to ASTM C171.
6. Application of other moisture retaining covering as approved.
7. Application of a curing compound conforming to ASTM C309.

a. Apply curing compound in accordance with manufacturer's recommendations immediately after any water sheen which may develop after finishing has disappeared from concrete surface.

b. Do not use on any surface against which additional concrete or other material is to be bonded unless it is proven that curing compound will not prevent bond.

c. Where a vertical surface is cured with a curing compound, the vertical surface shall be covered with a minimum of two (2) coats of the curing compound.

1) Apply the first coat of curing compound to a vertical surface immediately after form removal.

2) The vertical concrete surface at the time of receiving the first coat shall be damp with no free water on the surface.

3) Allow the preceding coat to completely dry prior to applying the next coat.

4) A vertical surface: Any surface steeper than 1 vertical to 4 horizontal.

d. Curing compounds used in water treatment plant construction shall be non-toxic and taste and odor free.

1) Curing compound to be NSF approved and have a moisture loss of not more than 0.62 kg/SQ meter per ASTM C156.

a) Atlas Tech Products Atlas Quantum-Cure.

2) Alternately, all tank surfaces shall be sand-blasted as required to remove non-NSF approved curing compound.

C. Curing Concrete In Contact with Forms:

1. Minimize moisture loss from and temperature gain of concrete placed in forms exposed to heating by sun by keeping forms wet and cool until they can be safely removed.
2. After form removal, cure concrete until end of time prescribed.

a. Use one of methods listed above.

3. Forms left in place shall not be used as a method of curing in hot weather.
4. The term "hot weather," where used in these specifications, is defined in ACI 305R.
5. In hot weather, remove forms from vertical surfaces as soon as concrete has gained sufficient strength so that the formwork is no longer required to support the concrete.

D. Continue curing for at least seven (7) days for all concrete except high early strength concrete for which period shall be at least three (3) days.

1. If one of curing procedures indicated above is used initially, it may be replaced by one of other procedures indicated any time after concrete is one (1) day old, provided concrete is not permitted to become surface dry during transition.

E. Cold Weather:

1. Follow recommendations of ACI 306R.
2. Maintain temperature of concrete between 50 and 70 DegF for required curing period, when outdoor temperature is 40 DegF, or less.
3. Use heating, covering, insulating, or housing of the concrete work to maintain required temperature without injury due to concentration of heat.
4. Do not use combustion heaters unless precautions are taken to prevent exposure of concrete to exhaust gases which contain carbon dioxide.
5. Interior slabs in areas intended to be heated shall be adequately protected so that frost does not develop in the supporting subgrade.

F. Hot Weather:

1. Follow recommendations of ACI 305R.
2. Make provision for cooling forms, reinforcement and concrete, windbreaks, shading, fog spraying, sprinkling, ponding, or wet covering with a light colored material.
3. Provide protective measures as quickly as concrete hardening and finishing operations will allow.

G. Rate of Temperature Change:

1. Keep changes in temperature of air immediately adjacent to concrete as uniform as possible, during and immediately following curing period.
2. Do not exceed a temperature change of 5 DegF in any 1 HR or 50 DegF in any 24 HR period.

H. Protection from Mechanical Injury:

1. Protect concrete from damaging mechanical disturbances, such as load stresses, heavy shock, and excessive vibration.
2. Protect finished concrete surfaces from damage by construction equipment, materials, or methods, and by rain or running water.
3. Do not load self-supporting structures in such a way as to overstress concrete.

3.8 FIELD QUALITY CONTROL

A. Tests in accordance with Specification Section 03 05 05 – Testing.

1. Perform a strength test on all concrete to which water or superplasticizer, above the amount stated in the approved concrete mix design, has been added.
   a. Perform sampling after water or superplasticizer has been added and additional mixing has been performed.

B. Field samples of fabricated waterstop fittings (crosses, tees, etc.) will be selected at random by the Owner’s representative for testing by a laboratory at the Owner's expense.

1. When tested, they shall have a tensile strength across the joints equal to at least 600 psi.

3.9 OWNER TRAINING (NOT USE)

END OF SECTION

SECTION 32 11 13.01

LIME/FLY–ASH STABILIZED SUBGRADE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. Foundation course of lime/fly-ash stabilized subgrade material, application of lime slurry and fly-ash to subgrade, and mixing, compaction, and curing of lime, slurry, fly-ash, water and subgrade into a stabilized foundation.
2. Limits for installed lime/fly ash stabilized subgrade material: Extends 1 foot beyond outside edge of proposed pavement, except where proposed pavement section shares a common longitudinal or transverse edge with existing pavement section.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Section 32 11 13.13 – Lime Treated Subgrades

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

1.3 DEFINITIONS

A. Moist Cure: Curing soil lime/fly-ash material to obtain optimum hydration:

B. 1,000-Foot Roadway Section: 1,000 feet per lane width or approximately 500 square yards of compacted subgrade for other than full-lane-width roadway sections.

1.4 REFERENCES

A. ASTM C 618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for use in Concrete Words and terms used in these Specifications are defined in ACI 116R.

1.5 SUBMITTALS

A. Conform to requirements of Section 01 33 00 – Submittals.

B. Submit certification that fly-ash, hydrated lime, quicklime, or commercial lime slurry complies with these specifications.

C. Submit weight tickets, certified by supplier, with each bulk delivery of materials to work site.

1.6 DELIVERY, STORAGE AND HANDLING

A. Conform to requirements of Section 32 11 13.13 – Lime Treated Subgrades.

B. Quicklime can be dangerous; exercise extreme caution if used for Work. Become informed about recommended precautions in handling, storage and use of quicklime.

1.7 WARRANTY (NOT USED)

PART 2 - PRODUCTS

2.1 MATERIALS

A. Water: clean, clear and free from oil, acids, alkali, or vegetable matter.

B. Conform to requirements of Section 32 11 13.13 – Lime Treated Subgrades for Type A hydrated lime, Type C quicklime, and Type B commercial lime slurry shall.

C. Fly-Ash: Residue or ash remaining after burning finely pulverized coal at high temperatures conforming to requirements of ASTM C 618, Class C, and following:

1. Minimum CaO content of 20 percent.
2. Loss on ignition not to exceed 3 percent.
3. Contain no lignite ash.

D. Asphaltic Seal Cure: Conform to requirements of Section 32 11 13.13 – Lime Treated Subgrades.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Conform to Part 3 of Section 32 11 13.13 – Lime Treated Subgrades with following exceptions.

1. Include fly ash in percentage amounts in lime or lime slurry as established from geotechnical evaluation for application, mixing, and compaction.
2. Apply lime/fly-ash as single mix, single pass over lower PI soils.
3. Conduct operations to minimize elapsed time between mixing and compacting lime/fly-ash stabilized subgrade in order to take advantage of rapid initial set characteristics. Complete compaction within 2 hours of commencing compaction, and not more than 6 hours after adding and mixing last stabilizing agent.

3.2 QUALITY CONTROL

A. Testing will be performed under provisions of Section 01 45 29 – Testing and Laboratory Services

B. Soil will be sampled to establish percent of fly-ash and hydrated lime, quicklime, or lime slurry to be applied to subgrade material.

C. Testing will be in accordance with Part 3 of Section 32 11 13.13 – Lime Treated Subgrades.

3.3 OWNER TRAINING (NOT USED)

END OF SECTION

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SECTION 32 11 13.02

PORTLAND CEMENT-STABILIZED SUBGRADE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Foundation course of Portland cement stabilized natural subgrade material.
2. Limits for installed Portland cement treated subgrade material: Extends 1 foot beyond outside edge of proposed pavement, except where proposed pavement section shares a common longitudinal or transverse edge with existing pavement section.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

1.3 REFERENCES

A. C 150 – Standard Specification for Portland Cement.

B. ASTM D 558 – Standard Test Methods for Moisture-Density (Unit Weight) Relations of Soil-Cement-Mixtures.

C. ASTM D 1556 – Standard Test Methods for Density and Unit Weight of Soil in Place by the Sand-Cone Method.

D. ASTM D 6938 – Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

E. ASTM D 4318 – Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.4 SUBMITTALS

A. Conform to requirements of Section 01 33 00 – Submittals.

B. Submit certification that Portland cement complies with these specifications.

1.5 WARRANTY (NOT USED)

PART 2 - PRODUCTS

2.1 WATER

A. Water: clean, clear and free from oil, acids, alkali, or organic matter.

2.2 PORTLAND CEMENT

A. ASTM C 150 Type I: bulk or sacked.

2.3 SOIL

A. Provide soil consisting of approved material free from vegetation or other objectionable matter.

2.4 TESTS

A. Testing will be performed under provisions of Section 01 45 29 – Testing Laboratory Services.

B. Tests and analysis of soil materials will be performed in accordance with ASTM D 4318.

C. Soil will be evaluated to establish ratio of cement to soil to obtain desired stability. Normal range is 6 percent to 10 percent by weight.

D. The percentage of moisture in soil, at time of cement application, will be determined by ASTM D558. Moisture will not be allowed to exceed quantity that will permit uniform, complete mixture of soil and cement during dry mixing operations nor specified optimum moisture content for soil cement mixture, as determined.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify compacted subgrade is ready to support imposed loads.

B. Verify subgrade lines and grades are correct.

3.2 EQUIPMENT

A. Apply Portland cement treatment with machine or combination of machines and auxiliary equipment to produce specified results. Mixing may be accomplished by multiple-pass traveling mixing plant or single-pass traveling mixing plant. Provide sufficient equipment to enable continuous prosecution of work.

3.3 PREPARATION

A. Backfill for utilities below future grade.

B. Verify subgrade is firm and able to support, without displacement, construction equipment at specified density. Correct soft or yielding subgrade and stabilize by scarifying and aerating or by adding cement and compacting to uniform stability.

C. Grade, shape, and compact, as required, to allow construction of Portland cement treatment for in-place materials to lines, grades, thickness, and typical cross section shown on Drawings. Remove unsuitable soil or material and replace with acceptable material.

D. Pulverize soil so that at completion of moist-mixing, 100 percent by dry weight passes 1-inch sieve, and minimum of 80 percent passes No. 4 sieve, exclusive of gravel or stone retained on these sieves. Pulverize existing bituminous wearing surfaces so that 100 percent will pass 2-inch sieve.

3.4 MIXING

A. Do not place and mix cement when temperature is below 40 degrees F and falling. Place base when temperature taken in shade and away from artificial heat is above 35 degrees F and rising.

B. Spread cement uniformly on soil at rate specified by laboratory. When bulk cement spreader is used, position it by string lines or other approved method to ensure uniform distribution of cement. Apply cement only to area where operations can be continuous and completed in daylight, within 1 hour of application. Amount of moisture in soil at time of cement placement shall not exceed quantity that will permit uniform mixture of soil and cement during dry mixing operations. Do not exceed specified optimum moisture content for soil cement mixture.

C. Do not allow equipment other than that used in spreading and mixing, to pass over freshly spread cement until it is mixed with soil.

D. Dry mix cement with soil after cement application. Continue mixing until cement has been sufficiently blended with soil to prevent formation of cement balls when water is applied. Mixture of soil and cement that has not been compacted and finished shall not remain undisturbed for more than 30 minutes.

E. Immediately after dry mixing is complete, uniformly apply water as necessary and incorporate it into mixture. Pressurized equipment must provide adequate supply to ensure continuous application of required amount of water to sections being processed within 3 hours of cement application. Ensure proper moisture distribution at all times. After last increment of water has been added, continue mixing until thorough and uniform mix has been obtained.

F. Ensure percentage of moisture in mixture, based on dry weights, is within 2 percentage points of specified optimum moisture content prior to compaction. When uncompacted soil cement mixture is wetted by rain indicating that average moisture content exceeds tolerance given at time of final compaction, reconstruct entire section in accordance with this Section at no additional cost to Owner.

3.5 COMPACTION

A. Prior to beginning compaction, ensure mixture is in loose condition for its full depth. Uniformly compact loose mixture to specified density, lines, and grades.

B. After soil and cement mixture is compacted, apply water uniformly as needed and mix thoroughly. Then reshape surface to required lines, grades, and cross section and lightly scarify to loosen imprints left by compacting or shaping equipment.

C. Roll resulting surface with pneumatic-tired roller and "skin" surface with power grader. Thoroughly compact with pneumatic roller, adding small increments of moisture, as needed. When aggregate larger than No. 4 sieve is present in mixture, make one complete coverage of section with flat-wheel roller immediately after skinning operation. When approved by Owner's representative, surface finishing methods may be varied from this procedure, provided dense uniform surface, free of surface compaction planes, is produced. Maintain moisture content of surface material at its specified optimum during finishing operations. Compact and finish surface within period not to exceed 2 hours, to produce smooth, closely knit surface, free of cracks, ridges, or loose material, conforming to crown, grade, and line shown on Drawings within period not to exceed 2 hours.

3.6 CONSTRUCTION JOINTS

A. At end of each day's construction, form straight transverse construction joint by cutting back into total width of completed work to form true 2-inch depth vertical face free of loose and shattered material. Construct cement treatment for large wide areas in series of parallel lanes of convenient length and width approved in advance by Owner's representative.

3.7 CURING

A. Moist cure for minimum of 3 days before placing base or surface course, or opening to traffic. When open, restrict traffic to light pneumatic rollers or vehicles weighing less than 10 tons.

B. Keep subgrade surface damp by sprinkling. Roll with light pneumatic roller to keep surface knit together.

C. Place base and surface within 14 days after final mixing and compaction, unless prior approval is obtained from Owner's Representative.

3.8 TOLERANCES

A. Completed surface: smooth and conforming to typical section and established lines and grades.

B. Top of compacted surface: Plus or minus ¼-inch in cross section or in 16-foot length.

3.9 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of Section 01 45 29 – Testing and Laboratory Services.

B. In-place density will be determined in accordance with ASTM D 6938 or ASTM D 1556. Minimum of three tests will be taken for each 1000 feet per lane of roadway or 500 square yards of embankment.

3.10 PROTECTION

A. Maintain stabilized subgrade to lines and grades and in good condition until placement of base or surface course.

B. Repair defects immediately by replacing material to full depth.

3.11 OWNER TRAINING (NOT USED)

END OF SECTION

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SECTION 32 11 13.13

LIME-TREATED SUBGRADES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Foundation course of lime-stabilized subgrade material including application of lime slurry to subgrade, and mixing, compaction, and curing of lime slurry, water, and subgrade into a stabilized foundation.
2. Limits for installed lime treated subgrade material: Extends 1 foot beyond outside edge of proposed pavement, except where proposed pavement section shares a common longitudinal or transverse edge with existing pavement section.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

1.3 DEFINITIONS

A. Moist Cure: Curing soil and lime to obtain optimum hydration.

B. 1,000-Foot Roadway Section: 1,000 feet per lane width or approximately 500 square yards of compacted subgrade for other than full-lane-width roadway sections.

1.4 REFERENCES

A. ASTM D 698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3).

B. ASTM D 6938 – Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

C. ASTM D 4318 – Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

D. TxDOTTex-101-E – Preparing Soil and Flexible Base Material for Testing.

E. TxDOT Tex-140-E – Measuring Thickness of Pavement Layer.

F. TxDOT Tex-600-J – Sampling and Testing Hydrated Lime, Quicklime, and Commercial Lime Slurry.

1.5 SUBMITTALS

A. Conform to requirements of Section 01 33 00 – Submittals.

B. Submit certification that hydrated lime, quicklime, or commercial lime slurry complies with specifications.

C. Submit weight tickets, certified by supplier, with each bulk delivery of lime to work site.

1.6 DELIVERY, STORAGE AND HANDLING

A. Bagged lime shall bear manufacturer's name, product identification, and certified weight. Bags varying more than 5 percent of certified weight may be rejected; average weight of 50 random bags in each shipment shall not be less than certified weight.

B. Store lime in weatherproof enclosures. Protect lime from ground dampness.

1.7 WARRANTY (NOT USED)

PART 2 - PRODUCTS

2.1 WATER

A. Water: clean, clear and free from oil, acids, alkali, or organic matter.

2.2 LIME

A. Type A - Hydrated Lime: Dry material consisting essentially of calcium hydroxide or mixture of calcium hydroxide and an allowable percentage of calcium oxide as listed in chemical composition chart.

B. Type B - Commercial Lime Slurry: Liquid mixture consisting essentially of lime solids and water in slurry form. Water or liquid portion shall not contain dissolved material in sufficient quantity to be injurious or objectionable for purpose intended.

C. Type C - Quicklime: Dry material consisting essentially of calcium oxide. Furnish quicklime in either of the following grades:

1. Grade DS: Pebble quicklime of gradation suitable for use in preparation of slurry for wet placing.

2. Grade S: Finely-graded quicklime for use in preparation of slurry for wet placing. Do not use grade S quicklime for dry placing.

D. Conform to the following requirements:

CHEMICAL COMPOSITION	TYPE		
	A	B	C
Active lime content, % by weight $Ca(OH)_2$+CaO	90.0 min[1]	87.0 min[2]	-
Unhydrated lime content, % by weight CaO	5.0 max	-	87.0 min
Free water content, % by weight H_2O :	5.0 max	-	-
SIZING			
Wet Sieve, as % by weight residue retained:			
No. 6	0.2 max	0.2 max[2]	8.0 max[3]
No. 30	4.0 max	4.0 max[2]	-
Dry sieve, as % by weight residue retained:			
1-inch	-	-	0.0
¾-inch	-	-	10.0 max

Notes:

1. Maximum 5.0% by weight CaO shall be allowed in determining total active lime content.
2. Maximum solids content of slurry.
3. Total active lime content, as CaO, in material retained on No. 6 sieve shall not exceed 2.0% by weight of original Type C lime.

E. Deliver lime slurry to job site as commercial lime, or prepare at job site by using hydrated lime or quicklime. Provide slurry free of liquids other than water and of consistency that can be handled and uniformly applied without difficulty.

F. Lime containing magnesium hydroxide is prohibited.

2.3 SOIL

A. Soil to receive lime treatment may include borrow or existing subgrade material, existing pavement structure, or combination of all three. Where existing pavement or base material is encountered, pulverized or scarify material so that 100 percent of sampled material passes 2-inch sieve.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify compacted subgrade is ready to support imposed loads.

B. Verify subgrade lines and grades are correct.

3.2 PREPARATION

A. Complete backfill of utilities prior to stabilization.

B. Cut material to bottom of subgrade using an approved cutting and pulverizing machine meeting following requirements:

1. Cutters accurately provide smooth surface over entire width of cut to plane of secondary grade.

2. Provide cut to depth as specified or shown in the Drawings.

C. Alternatively, scarify or excavate to bottom of stabilized subgrade. Remove material or windrow to expose secondary grade. Obtain uniform stability.

D. Correct wet or unstable material below secondary grade by scarifying, adding lime, and compacting as directed by Owner's representative.

E. Pulverize existing material so that 100 percent passes a 1¾-inch sieve.

3.3 LIME SLURRY APPLICATION

A. Apply slurry with distributor truck equipped with an agitator to keep lime and water in consistent mixture. Make successive passes over measured section of roadway to attain proper moisture and lime content. Limit spreading to an area where preliminary mixing operations can be completed on same working day.

B. Minimum lime content shall be 5 percent of dry unit weight of subgrade as determined by ASTM D 698.

3.4 PRELIMINARY MIXING

A. Use approved single-pass or multiple-pass rotary speed mixers to mix soil, lime, and water to required depth. Obtain homogeneous friable mixture free of clods and lumps.

B. Shape mixed subgrade to final lines and grades.

C. Eliminate following operations and final mixing if pulverization requirements of Paragraph 3.5C can be met during preliminary mixing:

1. Seal subgrade as precaution against heavy rainfall by rolling lightly with light pneumatic rollers.

2. Cure soil-lime material for 24 to 72 hours or as required to obtain optimum hydration. Keep subgrade moist during cure.

3.5 FINAL MIXING

A. Use approved single-pass or multiple-pass rotary speed mixers to uniformly mix cured soil and lime to required depth.

B. Add water to bring moisture content of soil mixture to optimum or above.

C. Mix and pulverize until all material passes 1¾-inch sieve; minimum of 85 percent, excluding non-slacking fractions, passes ¾-inch sieve; and minimum of 60 percent excluding non-slacking fractions passes No. 4 sieve. Test according to TxDOT Tex-101-E, using dry method.

D. Shape mixed subgrade to final lines and grades.

E. Do not expose hydrated lime to open air for 6 hours or more during interval between application and mixing. Avoid excessive hydrated lime loss due to washing or blowing.

3.6 COMPACTION

A. Aerate or sprinkle to attain optimum moisture content to 3 percent above optimum, as determined by ASTM D 698 on material sample from roadway after final mix with lime.

B. Start compaction immediately after final mixing.

C. Spread and compact in two or more equal layers where total compacted thickness is greater than 8 inches.

D. Compact with approved heavy pneumatic or vibrating rollers, or combination of tamping rollers and light pneumatic rollers. Begin compaction at bottom and continue until entire depth is uniformly compacted.

E. Do not allow stabilized subgrade to mix with underlying material. Correct irregularities or weak spots immediately by replacing material and recompacting.

F. Compact subgrade to minimum density of 95 percent of maximum dry density, according to ASTM D 698, at moisture content of optimum to 3 percent above optimum, unless otherwise indicated on Drawings.

G. Seal with approved light pneumatic tired rollers. Prevent surface hair line cracking. Rework and recompact at areas where hairline cracking develops.

3.7 CURING

A. Moist cure for minimum of 3 days before placing base or surface course, or opening to traffic. Subgrade may be opened to traffic after 2 days when adequate strength has been attained to prevent damage. Restrict traffic to light pneumatic rollers or vehicles weighing less than 10 tons.

B. Keep subgrade surface damp by sprinkling. Roll with light pneumatic roller to keep surface knit together.

C. Place base or surface within 14 days after final mixing and compaction. Restart compaction and moisture content of base material when time is exceeded.

3.8 TOLERANCES

A. Completed surface: smooth and conforming to typical section and established lines and grades.

B. Top of compacted surface: Plus or minus ¼-inch in cross section or in 16-foot length.

C. Depth of lime stabilization shall be plus or minus one inch of specified depth for each 1,000-foot roadway section.

3.9 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of Section 01 45 29 – Testing and Laboratory Services.

B. Test soils, lime, and mixtures as follows:

1. Tests and analysis of soil materials will be performed in accordance with ASTM D 4318, using the wet preparation method.
2. Sampling and testing of lime slurry shall be in accordance with TxDOT Tex-600-J, except using a lime slurry cup.
3. Sample mixtures of hydrated lime or quicklime in slurry form will be tested to establish compliance with specifications.
4. Moisture-density relationship will be established on material sampled from roadway, after stabilization with lime and final mixing, in accordance with ASTM 698, Moist Preparation Method.

C. In-place depth will be evaluated for each 1,000-foot roadway section and determined in accordance with TxDOT Tex-140-E in hand excavated holes. For each 1,000-foot section, 3 phenolphthalein tests will be performed. Average stabilization depth for 1,000-foot section will be based on average depth for three tests.

D. Perform compaction testing in accordance with ASTM D 2922. Three tests will be performed for each 1,000-foot roadway section.

E. Pulverization analysis will be performed as required by Paragraph 3.05C on material sampled during mixing of each production area. Three tests will be performed per 1,000-foot roadway section or a minimum of once daily.

3.10 REWORK OF FAILED SECTIONS

A. Rework sections that do not meet specified thickness.

B. Perform the following steps when more than 72 hours have lapsed since completion of compaction.

1. Moist cure for minimum of 3 days after compaction to required density.
2. Add lime at rate of 25 percent of specified rate at no additional cost to Owner.
3. Moisture density test of reworked material must be completed by laboratory before field compaction testing can be completed.

3.11 PROTECTION

A. Maintain stabilized subgrade to lines and grades and in good condition until placement of base or surface course. Protect asphalt membrane from being picked up by traffic.

B. Repair defects immediately by replacing material to full depth.

3.12 OWNER TRAINING (NOT USED)

END OF SECTION

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SECTION 32 13 13

CONCRETE PAVEMENT, CURB, SIDEWALKS, AND STEPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete pavement, curb, sidewalk, and steps.

B. Related Specification Sections include, but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.
3. Section 03 05 05 – Testing.
4. Section 03 31 30 – Concrete, Materials and Proportioning.
5. Section 03 31 31 – Concrete Mixing, Placing, Jointing, and Curing.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. American Association of State Highway and Transportation Officials (AASHTO):
   a. M153 – Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction (ASTM D1752).
   b. M171 – Sheet Materials for Curing Concrete.
   c. M182 – Burlap Cloth Made from Jute or Kenaf.
   d. M213 – Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types) (ASTM D1751).
   e. M224 – Use of Protective Sealers for Portland Cement Concrete.
   f. M233 – Boiled Linseed Oil Mixture for Treatment of Portland Cement Concrete.

2. American Concrete Institute (ACI):
   a. 305R – Hot Weather Concreting.

b. 306R – Cold Weather Concreting.

3. ASTM International (ASTM):
   a. A185 – Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
   b. A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
   c. C33 – Standard Specification for Concrete Aggregates.
   d. C150 – Standard Specification for Portland Cement.
   e. C174 – Standard Test Method for Measuring Thickness of Concrete Elements Using Drilled Concrete Cores.
   f. C309 – Standard Specification Liquid Membrane-Forming Compounds for Curing Concrete.
   g. D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3).
   h. D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
   i. D1752 – Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
   j. D4253 – Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
   k. D4254 – Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
4. Federal Specification (FS):
   a. SS-S-1614 – Sealants, Joint, Jet-Fuel-Resistant, Hot-Applied for Portland Cement and Tar Concrete Pavements.
   b. TT-S 00227 E – Sealing Compound: Elastomeric Type, Multi-Component (for Calking, Sealing, and Glazing in Buildings and Other Structures).

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.

3. Mix design(s) in accordance with Specification Section 03 31 30 – Concrete, Materials and Proportioning and Specification Section 03 05 05 – Testing.
4. Test reports:
    a. Concrete cylinder Test results from field quality control.

1.5 WARRANTY (NOT USED)

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portland Cement: ASTM C150, Type I or II.

B. Aggregates:
    1. ASTM C33, gradation size #67, 3/4 IN to #4.
    2. Clean, crushed gravel.

C. Water: Clean, clear; and free from oil, acids, alkali, or vegetable matter.

D. Admixtures: Comply with Specification Section 03 31 30 – Concrete, Materials and Proportioning.

E. Reinforcing Bars: ASTM A615, Grade 60.

F. Welded Wire Reinforcement:
    1. ASTM A185.
    2. Flat.
    3. Clean, free from dirt, scale, rust.

G. Preformed Joint Filler:
    1. Non-extruding cork, self-expanding cork, sponge rubber or cork rubber.
    2. AASHTO M153 or AASHTO M213.

H. Hot-Poured Joint Sealing Material: FS SS-S-1614.

I. Sidewalk Joint Sealant:
    1. Two (2) compound polyurethane.
    2. Class A, Type 1.
    3. Self-leveling.
    4. Non-tracking.
    5. FS TT-S 00227 E(3).

J. Membrane Curing Compound: ASTM C309.

K. Cover Materials for Curing:
    1. Burlap:

a. AASHTO M182.

b. Minimum Class 2, 8 0Z material (1 YD x 42 IN).

2. Polyethylene film, AASHTO M171.

L. Paper Subgrade Cover: Polyethylene film, AASHTO M171.

M. Concrete Treatment:

1. Boiled linseed oil mixture.
2. AASHTO M233.

N. Forms:

1. Steel or wood.
2. Size and strength to resist movement during concrete placement and able to retain horizontal and vertical alignment.
3. Free of distortion and defects.
4. Full depth.
5. Metal side forms:

a. Minimum 7/32 IN thick.

b. Depth equal to edge thickness of concrete.

c. Flat or rounded top minimum 1-3/4 IN wide.

d. Base 8 IN wide or equal to height, whichever is less.

e. Maximum deflection 1/8 IN under center load of 1,700 LBS.

f. Use flexible spring steel forms or laminated boards to form radius bends.

2.2 MIXES

A. Mix design to provide 4,000 psi 28-day compressive strength, 1-1/2 IN plus 1 IN slump, 6 percent air.

B. Comply with Specification Section 03 31 30 – Concrete, Materials and Proportioning and Specification Section 03 31 31 – Concrete Mixing, Placing, Jointing, and Curing.

PART 3 - EXECUTION

3.1 PREPARATION

A. Subgrade Preparation:

1. Prepare using methods, procedures, and equipment necessary to attain required compaction densities, elevation and section.
2. Scarify and recompact top 6 IN of fills and embankments which will be under paved areas.

3. Remove soft or spongy areas.
4. Replace with aggregate material.
5. Compact to the following densities:
   a. Cohesive soils: 95 percent per ASTM D698.
   b. Non-cohesive soils: 75 percent relative per ASTM D4253 and ASTM D4254.
6. Assure moisture content is within limits prescribed to achieve required compaction density.
7. Following compaction, trim and roll to exact cross section.
   a. Check with approved grading template.
8. Perform density tests on subgrade to determine that subgrade complies with the specification.

B. Aggregate Course:
   1. Place material in not more than 6 IN thick layers.
   2. Spread, shape, and compact all material deposited on the subgrade during the same day.
   3. Compact to 75 percent relative per ASTM D4253 and ASTM D4254.

C. Loose and Foreign Material: Remove loose and foreign material immediately before application of paving.

D. Appurtenance Preparation:
   1. Block out or box out curb inlets and curb returns.
   2. Provide for joint construction as detailed and dimensioned on Drawings.
   3. Adjust manholes, inlets, valve boxes and any other utility appurtenances to design grade.
      a. Secure to elevation with concrete.
      b. Place concrete up to 5 IN below design grade.
   4. Headers:
      a. Construct at open ends of pavements.
      b. Use same concrete to construct headers as that used in the abutting structure.
      c. Extend header full width of pavement and crown same as pavement.
   5. Clean and oil forms.

3.2 INSTALLATION

A. Concrete Production: Comply with Specification Section 03 31 31 – Concrete Mixing, Placing, Jointing, and Curing.

B. Forms:
   1. Form support:
      a. Compact soil foundation and cut to grade to support forms and superimposed machine loads.
      b. Use bearing stakes driven flush with bottom of form to supplement support as necessary.
      c. Do not use earth pedestals.
   2. Staking forms:
      a. Joint forms neatly and tightly.
      b. Stake and pin securely with at least three (3) pins for each 10 FT section.
   3. Clean and oil forms prior to placement of concrete.
   4. Set forms sufficiently in advance of work (minimum of 2 HRS) to permit proper inspection.
   5. Previously finished concrete pavement, curb or sidewalk contiguous with new work may serve as side form when specifically approved.

C. Reinforcing:
   1. Locate longitudinal edge bars between 3 IN and 6 IN from edge of slab.
   2. Lap mats one (1) full space.
   3. Tie end transverse member of upper mat securely to prevent curving.
   4. Lap non-welded bars 12 IN minimum.
   5. Support:
      a. Place bars and heavy mats securely on chairs at called-for height.
      b. Place other fabric on the first of a two-course pour and cover promptly with final pour, or place fabric by a fabric-placer if procedure is reviewed and approved by Owner's Representative.

D. Joints:
   1. Hold joint location and alignment to within +1/4 IN.
   2. Finish concrete surface adjacent to previously placed slab to within +1/8 IN, with tooled radius of 1/4 IN.
   3. Metal keyway joints:
      a. Form by installing metal joint strip left in place.
      b. Stake and support like side form.
      c. Provide dowels or tie bars.
   4. Weakened plane joints:

a. Tooled joints:

1) Form groove in freshly placed concrete with tooling device.

2) Groove dimensions shall be 3/8 IN at surface and 1/4 IN at root.

b. Sawed joints:

1) Saw 1/4 IN groove in green concrete.

1) Commence sawing as soon as concrete is hard enough to withstand operation without chipping, spalling or tearing, regardless of nighttime or weather.

2) Thoroughly wet surface to protect membrane cure and recoat afterward.

3) Complete saw cutting before shrinkage stresses cause cracking.

c. Locate at 6 FT intervals.

5. Stake in place load transfer device for expansion joints consisting of dowels:

a. Supporting and spacing means and pre-molded joint filler as per Drawing details.

b. Located at 48 FT intervals and at all intersection curb returns.

c. Provide preformed joint filler at all junctions with existing curb, sidewalk, steps, or other structures.

6. Install construction joints at end of day's work or wherever concreting must be interrupted for 30 minutes or more.

7. Thoroughly clean and fill joints with joint sealing material as specified.

8. Fill joints without overflowing onto pavement surface.

9. Upper surface of filled joint to be flush to 1/8 IN below finish surface.

E. Place Concrete:

1. Comply with Specification Section 03 31 31 – Concrete Mixing, Placing, Jointing, and Curing.

2. Construct driveway openings, ramps, and other features as per Drawing details.

F. Cold and Hot Weather Concreting:

1. Cold weather:

a. Cease concrete placing when descending air temperature in shade falls below 40 Deg F.

b. Do not resume until ambient temperature rises to minimum 40 Deg F.

c. If placing below 40 Deg F is authorized by Owner’s Representative, maintain temperature of mix between 60 and 80 Deg F.

d. Heat aggregates or water or both.

e. Water temperature may not exceed 175 Deg F.

f. Aggregate temperature may not exceed 150 Deg F.

g. Remove and replace frost damaged concrete.

h. Salt or other antifreeze is not permitted.

i. Comply with ACI 306R.

2. Hot weather:

a. Cease concrete placing when plastic mix temperature cannot be maintained under 90 Deg F.

b. Aggregates or water or both may be cooled.

c. Cool water with crushed ice.

d. Cool aggregates by evaporation of water spray.

e. Never batch cement hotter than 160 Deg F.

f. Comply with ACI 305R.

G. Finishing:

1. As soon as placed, strike off and screed to crown and cross section, slightly above grade, so that consolidation and finishing will bring to final Drawing elevations.

2. Maintain uniform ridge full width with first pass of first screed.

3. Pavement and similar surfaces:

a. Float by longitudinally reciprocating float, passing gradually from edge to edge.

b. Assure successive advances do not exceed half the length of the float.

c. Test level of slab with minimum 10 FT straightedge.

d. Fill depressions with fresh material, consolidate and refinish.

e. Cut down high areas and retest.

f. Belt surface with two-ply canvas belt, using transverse strokes while advancing along center line.

g. Provide final finish by full width burlap or carpet drag, drawn longitudinally.

h. Keep drag clean to avoid build up and consequent scarring.

i. Tool pavement edges with suitable edger.

j. Retest with straightedge and if pavement shows deviation of more than 1/8 IN in 10 FT, remove and replace.

4. Curb and similar surfaces:
    a. Bring curb to grade by running straightedge over steel templates with sawing motion.
    b. Float surface with a wood float to draw cement to surface.
    c. Broom finish after floating.
    d. Tool edges with suitable edger.
    e. Upon removal of forms, fill honeycombed or unevenly filled sections immediately with cement mortar.
    f. Assure that expansion joints are cleared of concrete.
5. Sidewalk, steps, ramps, and similar surfaces:
    a. Test with 6 FT straightedges equipped with long handles and operated from off the sidewalk.
    b. Draw excess water and laitance off from surface.
    c. Float finish so as to leave no disfiguring marks, but to produce a uniform granular or sandy texture.
    d. Broom finish after floating.
    e. Tool pavement edges with suitable edger.
    f. Provide exposed aggregate surfaces in areas indicated on the Drawings.
    g. Provide method such as abrasive blasting, bush hammering, or surface retarder acceptable to the Owner's Representative.

H. Curing:
1. Apply membrane curing compound complying with ASTM C309, and in accordance with manufacturer's directions, but at a minimum rate of 200 SF per gallon.
2. Apply curing compound within 4 HRS after finishing or as soon as surface moisture has dissipated.
3. Cure for minimum of seven (7) days.
4. When average daily temperature is below 50 Deg F, provide insulating protection of 12 IN minimum thickness loose dry straw, or equivalent, for 10 days.
5. Linseed oil sealant:
    a. For concrete pavement or sidewalk, seal surface with linseed oil.
    b. Apply linseed oil to clean surface as per AASHTO M224 after concrete has cured for one (1) month.
    c. Apply first application at minimum rate of 67 SY per gallon.

d. Apply second application to a dry surface at minimum rate of 40 SY per gallon.

I. Protection of Concrete:

1. Protect concrete surfaces and appurtenances from traffic for minimum of 14 days.
2. Erect and maintain warning signs, lights, watchmen to direct traffic.
3. Repair or replace parts of concrete surfaces damaged by traffic, or other causes, occurring prior to final acceptance.
4. Protect concrete pavement against public traffic, construction traffic and traffic caused by employees and agents.
5. No equipment shall be driven or moved across concrete surfaces unless such equipment is rubber-tired and only if concrete is designed for and capable of sustaining loads to be imposed by the equipment.
6. Do not drive over new or existing concrete with tracked vehicles and equipment.

J. Painting and Striping:

1. Stripe and mark pavement per the Drawings following sufficient cure time for pavement.
2. Lay out markings with guidelines, templates, and forms.
3. Apply 6 IN wide stripe with self-contained striping machine to a clean and dry pavement surface.
4. Temperature must be above 40 Deg F and precipitation should not be expected during drying period.
5. Use yellow or white paint as approved complying with FS TT-P-115.
6. Apply at 1 GAL per 105 SF.

K. Opening to Traffic:

1. After 14 days, pavement may, at Owner's discretion, be opened to traffic if job cured test cylinders have attained a compressive strength of 3,000 LBS per square inch when tested in accordance with ASTM standard methods.
2. Prior to opening to traffic, clean and refill joints as required with the specified filler material.

L. Clean Up:

1. Assure clean up work is completed within two (2) weeks after pavement has been opened to traffic.
2. No new work will begin until clean up work has been completed, or is maintained within two (2) weeks after pavement has been opened to traffic.

M. Pavement Patching:

1. Comply with material and density requirements as mentioned elsewhere in this Specification Section except provide minimum 6 IN aggregate immediately below the patch.
2. Place pavement patch providing a thickened edge.
3. Assure that patch in plane of "cold" joint has a thickness 6 IN greater than that of the existing pavement.
4. Extend patch under existing pavement for a distance of 6 IN minimum.
5. Fill void under existing pavement with concrete.
6. Undercut existing pavement 6 IN all around patch and to a depth of 6 IN.
7. Prior to placing patch, sawcut edge of existing concrete to 1/4 depth and remove to provide a vertical face for a straight and true joint.

3.3 FIELD QUALITY CONTROL

A. Provide test cylinders in accordance with Specification Section 03 05 05 – Testing for each 60 CY of concrete placed.

B. Pavement Thickness Testing:

1. General:
   a. Core pavement to determine the actual thickness as directed by Owner's Representative.
   b. Determine thickness by ASTM C174.
   c. Fill holes from removal of cores with concrete of the same mixture as specified.
   d. Cost incidental to coring of cores showing a deficiency greater than 1/4 IN shall be paid by the Contractor.
   e. Cost of cores showing a deficiency of 1/4 IN or less shall be paid by the Owner.
   f. If average pavement thickness, as directed by core measurement, is outside specified tolerances, payment will be reduced per PART 1 of this Specification Section.
   g. If deficiency in pavement thickness is 1 IN or more, remove and replace pavement at Contractor's expense.
2. Core categories:
   a. In determining the average thickness of acceptable pavement for which payment will be made, utilize the following core categories:

CATEGORY NUMBER	CORE THICKNESS IN RELATION TO DESIGN	CORE LENGTH USED IN CALCULATING
1	1 IN or more deficiency	NOT USED

2	Less than 1 IN deficiency through 1/2 IN excess	Actual Core Thickness
3	More than 1/2 IN excess	Design Thickness plus 1/2 IN

b. Core sampling:

1) Take cores in each lane in each block.

c. Take cores at locations where the cement content was found to be low when checking the quantities of cement used during the progress of the work.

d. Each separately poured lane of the pavement to be considered as a unit.

e. A lane shall be considered to be the pavement surface between longitudinal construction joints, between a longitudinal construction joint and the edge, or between two (2) pavement edges in cases where the entire width of the pavement is poured in one (1) operation.

f. Should any core show a deficiency in thickness in excess of 1 IN, check cores shall be taken 5 FT on either side of this location parallel to the centerline of the pavement.

g. If both of these cores are within the 1 IN tolerance, no further special borings for this individual zone of deficiency will be made.

h. If either one (1) or both of these cores are not within the 1 IN tolerance, the procedure will be to cut cores in the following order on either side of the original short core parallel to the centerline of the pavement:

1) 25 FT, 50 FT, the same to be measured from the location of original core found to be deficient in thickness, then at 50 FT intervals until a thickness within the 1 IN tolerance is found in both directions.

2) On either side of the original deficient core, the procedure will then be to make a coring approximately half the distance within the first core which comes within the 1 IN tolerance.

3) Repeat the above procedure until the station (+5 FT), at which the pavement comes within the 1 IN tolerance is located.

4) If for some reason two (2) or more cores are taken at the same station and at least one (1) of them is beyond the 1 IN tolerance, the section of pavement at the station shall be considered as unacceptable.

3.4 OWNER TRAINING (NOT USED)

END OF SECTION

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SECTION 32 90 00

SEEDING, SODDING AND LANDSCAPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Seeding, sodding and landscape planting:

B. Related Specification Sections include, but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. Payment to be made on a price per square yard (SY), installed, complete in place.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. American Nursery and Landscape Association/American National Standards Institute (ANLA/ANSI):
   a. Z60.1 – American Standard for Nursery Stock.
2. AOAC International (AOAC – Association of Official Agricultural Chemists.).
3. ASTM International (ASTM):
   a. D2028 – Standard Specification for Cutback Asphalt (Rapid-Curing Type).
   b. D5276 – Standard Test Method for Drop Test of Loaded Containers by Free Fall.

B. Quality Control:

1. Fertilizer:
   a. If Owner's Representative determines fertilizer requires sampling and testing to verify quality, testing will be done at Contractor's expense, in accordance with current methods of the AOAC.
   b. Upon completion of Project, a final check of total quantities of fertilizer used will be made against total area seeded.

c. If minimum rates of application have not been met, Contractor will be required to distribute additional quantities to make up minimum application specified.

1.4 SUBMITTALS

A. Shop Drawings:

B. See Specification Section 01 33 00 – Submittals for requirements for the mechanics and administration of the submittal process.

C. Product technical data including:

1. Acknowledgement that products submitted meet requirements of standards referenced.

1.5 SEQUENCING AND SCHEDULING

A. Pre-installation Meeting:

1. Meet with Owner's Representative and other parties as necessary to discuss schedule and methods, unless otherwise indicated by Owner's Representative.

1.6 WARRANTY (NOT USED)

PART 2 - PRODUCTS

2.1 MATERIALS

A. St. Augustine Sod

B. Soil Amendments:

C. Asphalt Binder: Emulsified asphalt per State specifications.

D. Water:

1. Water free from substances harmful to grass or sod growth.
2. Provide water from source approved prior to use.

PART 3 - EXECUTION

3.1 SOIL PREPARATION

A. General:

1. Limit preparation to areas which will be planted soon after.
2. Provide facilities to protect and safeguard all persons on or about premises.
3. Protect existing trees designated to remain.

4. Verify location and existence of all underground utilities.
    a. Take necessary precaution to protect existing utilities from damage due to construction activity.
    b. Repair all damages to utility items at no cost to Owner.
5. Provide facilities such as protective fences and/or watchmen to protect work from vandalism.
    a. Contractor to be responsible for vandalism until acceptance of work in whole or in part.

B. Preparation for Lawn-Type Seeding, Sprigging, Plugging or Sodding:

1. Loosen surface to minimum depth of 4 IN.
2. Remove stones over 1 IN in any dimension and sticks, roots, rubbish, and other extraneous matter.
3. Prior to applying fertilizer, loosen areas to be seeded with a double disc or other suitable device if the soil has become hard or compacted.
4. Correct any surface irregularities in order to prevent pocket or low areas which will allow water to stand.
5. Distribute fertilizer uniformly over areas to be seeded:
    a. For lawn-type seeding: 30 LBS per 1000 SF.
    b. For pasture seeding: 200 LBS per acre.
6. Incorporate fertilizer into soil to a depth of at least 2 IN by disking, harrowing, or other approved methods.
7. Remove stones or other substances from surface which will interfere with turf development or subsequent mowing operations.
8. Grade lawn areas to a smooth, even surface with a loose, uniformly fine texture.
    a. Roll and rake, remove ridges and fill depressions, as required to meet finish grades.
    b. Limit fine grading to areas which can be planted soon after preparation.
9. Restore lawn areas to specified condition if eroded or otherwise disturbed after fine grading and before planting.
10. Spread limestone uniformly over designated areas at a rate of 100 LBS per 1000 SF.
11. Distribute fertilizer as specified uniformly over areas to be seeded at a rate of 12 LBS per 1000 SF.

C. Native Grass Seeding:

3.2 INSTALLATION

A. Lawn-Type and Pasture Seeding:

1. Do not use seed which is wet, moldy, or otherwise damaged.
2. Perform seeding work from April 20 to May 15 for spring planting, and August 1 to September 15 for fall planting, unless otherwise approved by Owner's Representative.
3. Employ satisfactory methods of sowing using mechanical power-driven drills or seeders, or mechanical hand seeders, or other approved equipment.
4. Distribute seed evenly over entire area at rate of application not less than 4 LBS (PLS) of seed per 1000 SF, 50 percent sown in one direction, remainder at right angles to first sowing.
5. Stop work when work extends beyond most favorable planting season for species designated, or when satisfactory results cannot be obtained because of drought, high winds excessive moisture, or other factors.
   a. Resume work only when favorable conditions develop.
6. Lightly rake seed into soil followed by light rolling or cultipacking.
7. Immediately protect seeded areas against erosion by mulching.
   a. Spread mulch in continuous blanket using 1-1/2 tons per acre to a depth of 4 or 5 straws.
8. Protect seeded slopes against erosion with erosion netting or other methods approved by Owner's Representative.
   a. Protect seeded areas against traffic or other use by erecting barricades and placing warning signs.
9. Immediately following spreading mulch, anchor mulch using a rolling coulter or a wheatland land packer having wheels with V-shaped edges to force mulch into soil surface, or apply evenly distributed emulsified asphalt at rate of 10-13 GAL/1000 SF.
   a. SS-1 emulsion in accordance with ASTM D5276 or RC-1 cutback asphalt in accordance with ASTM D2028 are acceptable.
   b. If mulch and asphalt are applied in one treatment, use SS-1 emulsion with penetration test range between 150-200.
   c. Use appropriate shields to protect adjacent site improvements.

3.3 MAINTENANCE AND REPLACEMENT

A. General:

1. Begin maintenance of planted areas immediately after each portion is planted and continue until final acceptance or for a specific time period as stated below, whichever is the longer.

2. Provide and maintain temporary piping, hoses, and watering equipment as required to convey water from water sources and to keep planted areas uniformly moist as required for proper growth.
3. Protection of new materials:
    a. Provide barricades, coverings or other types of protection necessary to prevent damage to existing improvements indicated to remain.
    b. Repair and pay for all damaged items.
4. Replace unacceptable materials with materials and methods identical to the original specifications unless otherwise approved by the Owner's Representative.

B. Seeded or Sodded Lawns:

1. Maintain seeded lawns: 90 days, minimum, after installation and review of entire project area to be planted.
2. Water to be provided by Owner.
3. Maintenance period begins at completion of planting or installation of entire area to be seeded or sodded.
4. Owner's Representative will review seeded or sodded lawn area after installation for initial acceptance.
5. Maintain lawns by watering, fertilizing, weeding, mowing, trimming, and other operations such as rolling, regrading, and replanting as required to establish a smooth, uniform lawn, free of weeds and eroded or bare areas.
6. Lay out temporary lawn watering system and arrange watering schedule to avoid walking over muddy and newly seeded areas.
    a. Use equipment and water to prevent puddling and water erosion and displacement of seed or mulch.
7. Mow lawns as soon as there is enough top growth to cut with mower set at recommended height for principal species planted.
    a. Repeat mowing as required to maintain height.
    b. Do not delay mowing until grass blades bend over and become matted.
    c. Do not mow when grass is wet.
    d. Time initial and subsequent mowings as required to maintain a height of 1-1/2 to 2 IN.
    e. Do not mow lower than 1-1/2 IN.
8. Remulch with new mulch in areas where mulch has been disturbed by wind or maintenance operations sufficiently to nullify its purpose.
    a. Anchor as required to prevent displacement.

9. Unacceptable plantings are those areas that do not meet the quality of the specified material, produce the specified results, or were not installed to the specified methods.
10. Replant bare areas using same materials specified.
11. Owner's Representative will review final acceptability of installed areas at end of maintenance period.
12. Maintain repaired areas until remainder of maintenance period or approved by Owner's Representative, whichever is the longer period.

3.4 OWNER TRAINING (NOT USED)

END OF SECTION

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SECTION 32 91 05

TOPSOILING AND FINISHED GRADING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Topsoiling and finished grading.

B. Related Specification Sections include, but are not necessarily limited to:

1. Division 00 – Proposing Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 – General Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price. No separate payment will be made for this item. Include the cost in associated items for this project.

1.3 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 – Submittal for requirements for the mechanics and administration of the submittal process.
2. Project Data: Test reports for furnished topsoil.

1.4 SITE CONDITIONS

A. Verify amount of topsoil stockpiled and determine amount of additional topsoil, if necessary, to complete work.

B. Location of Work: All areas within limits of grading and all areas outside limits of grading which are disturbed in the course of the work.

1.5 WARRANTY (NOT USED)

PART 2 - PRODUCTS

2.1 MATERIALS

A. Topsoil:

1. Imported, Original surface soil typical of the area.
2. Capable of supporting native plant growth.
3. pH: 5.5 to 8.5.
4. Liquid Limit: 50 or less.
5. Plasticity Index: 20 or less.

6. Gradation: maximum of 10 percent passing No. 200 sieve.

2.2 TOLERANCES

A. Finish Grading Tolerance: 0.1 FT plus/minus from required elevations.

PART 3 - EXECUTION

3.1 PREPARATION

A. Correct, adjust and/or repair rough graded areas.
   1. Cut off mounds and ridges.
   2. Fill gullies and depressions.
   3. Perform other necessary repairs.
   4. Bring all sub-grades to specified contours, even and properly compacted.

B. Loosen surface to depth of 2 IN, minimum.

C. Remove all stones and debris over 2 IN in any dimension.

3.2 PLACING TOPSOIL

A. Do not place when subgrade is wet or frozen enough to cause clodding.

B. Spread to compacted depth of 4 IN for all disturbed earth areas.

C. If topsoil stockpiled is less than amount required for work, furnish additional topsoil at no cost to Owner.

D. Provide finished surface free of stones, sticks, or other material 1 IN or more in any dimension.

E. Provide finished surface smooth and true to required grades.

F. Restore stockpile area to condition of rest of finished work.

3.3 ACCEPTANCE

A. Upon completion of topsoiling, obtain Owner's Representative acceptance of grade and surface.

B. Make test holes where directed to verify proper placement and thickness of topsoil.

3.4 OWNER TRAINING (NOT USED)

END OF SECTION

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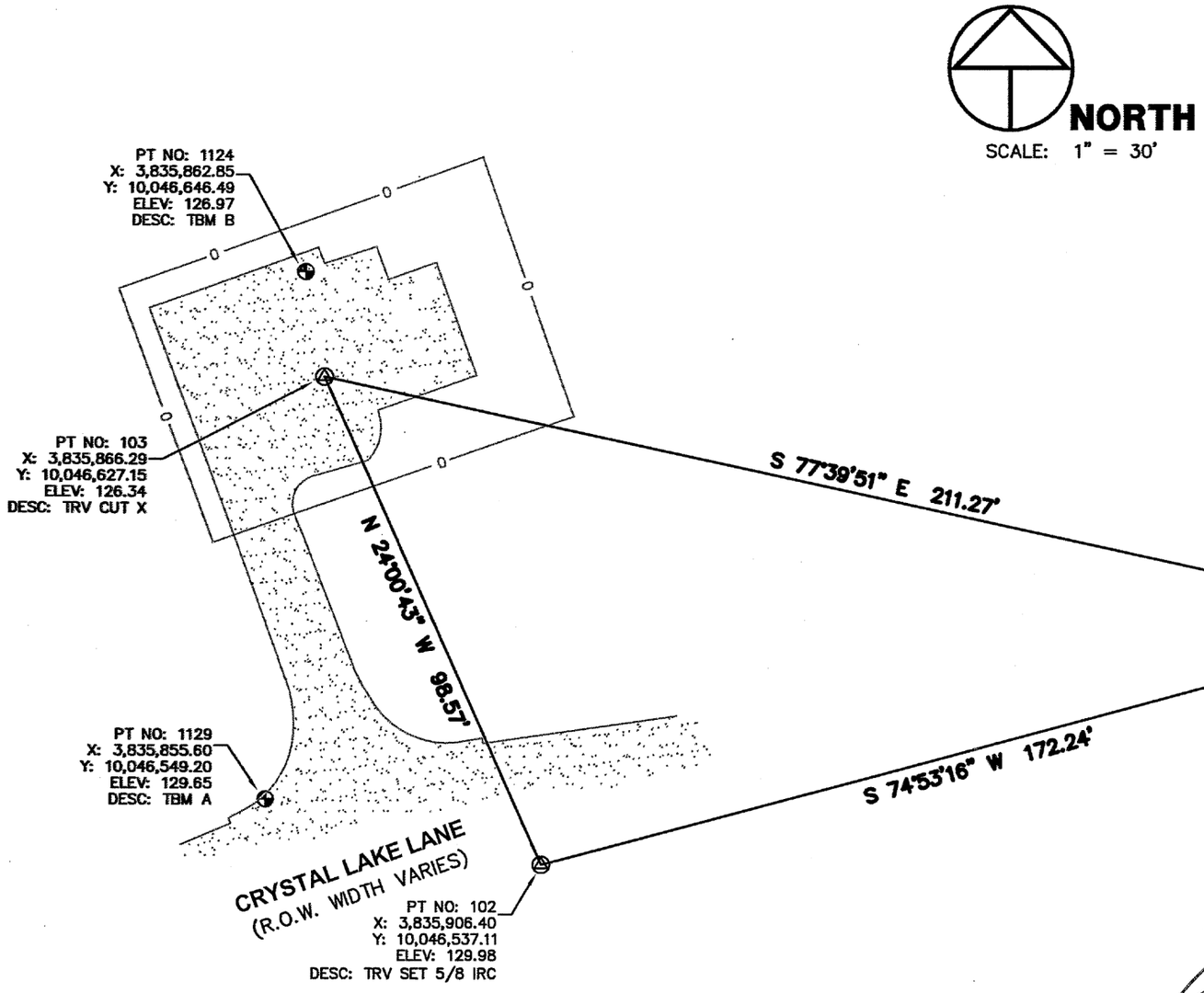
APPENDIX A



GENERAL NOTES

1. SURVEYOR DID NOT ABSTRACT SUBJECT PROPERTY, THIS SURVEY WAS PREPARED WITHOUT THE BENEFIT OF A CURRENT TITLE REPORT OR ABSTRACTORS CERTIFICATE AND WOULD BE SUBJECT TO ANY AND ALL CONDITIONS OR RESTRICTIONS THAT A CURRENT TITLE REPORT OR ABSTRACTORS CERTIFICATE MAY DISCLOSE.
2. BEARINGS SHOWN (IF ANY) WERE BASED ON THE TEXAS STATE PLANE COORDINATE SYSTEM, CENTRAL ZONE. (NAD83)
3. COORDINATES SHOWN (IF ANY) ARE REFERENCED TO THE TEXAS COORDINATE SYSTEM OF 1983, CENTRAL ZONE (NAD83, CORS), AND THE SJRA GROUND WATER REDUCTION PLAN PROJECT HORIZONTAL CONTROL DATUM. ALL COORDINATES AND DISTANCES HAVE BEEN SCALED FROM THEIR GRID VALUES TO SURFACE USING A COMBINED FACTOR OF 0.999995102 AND THE FORMULA: SURFACE=GRID/COMBINED FACTOR.
4. ALL ELEVATIONS ARE REFERENCED TO THE SJRA GROUNDWATER REDUCTION PLAN PROJECT VERTICAL CONTROL DATUM. PROJECT BENCHMARK: SJRA BENCHMARK NO. 49, ELEVATION=112.58
5. THIS EXHIBIT DOES NOT IMPLY TO BE A LAND TITLE SURVEY OF THE SUBJECT PROPERTY AND IS NOT INTENDED TO BE USED FOR TITLE CONVEYANCE PURPOSES.

10/11/16

STATE OF TEXAS
REGISTERED
RONALD PATRICK KELL
6424
PROFESSIONAL
LAND SURVEYOR

RONALD PATRICK KELL
Registered Professional Land Surveyor
Texas Registration No. 6424

10/11/2016
DATE

Z:\53270-SJRA LIFT STATION NO 4 REHABILITATION\SURVEY\53270-SCM.DWG - TWHATLEY - 10/12/16

SURVEY CONTROL MAP OF SJRA LIFT STATION NO. 4 SITUATED IN THE MONTGOMERY COUNTY SCHOOL LAND SURVEY, A-599 MONTGOMERY COUNTY, TEXAS

FIELDED BY:	JM	DATE:	10/11/2016
DRAWN BY:	TMW	REV:	
CHECKED BY:	RPK	REV:	
JOB NO.	53270	REV:	
SHEET 1 OF 1		REV:	

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LAND SURVEYING I PLATTING
3200 WILCREST, SUITE 325 I HOUSTON, TX 77042 I 713.458.2281
FIRM REGISTRATION NO. 10108800 I WINDROSESERVICES.COM