SECTION 01041
Project Coordination

PART 1 GENERAL

1.1 SCOPE

A. Management of the Project shall be through the use of a logical method of construction planning, inspection, scheduling and cost value documentation.

B. The work under this Section includes all surface and subsurface condition inspections and coordination by the Contractor necessary for the proper and complete performance of the Work.

C. This Section applies to the work of every division and every section of these Specifications.

1.2 SITE CONDITIONS

A. Inspection

1. Prior to performing any work under a section, the Contractor shall carefully inspect the installed work of other trades and verify that all such work is complete to the point where the work under that section may properly commence.

2. The Contractor shall verify that all materials, equipment and products to be installed under a section may be installed in strict accordance with the original design and pertinent reviewed shop drawings.

B. Discrepancies

1. In the event of discrepancy, immediately notify the Engineer.

2. Do not proceed with construction in areas of discrepancy until all such discrepancies have been fully resolved.

1.3 COORDINATION

A. Carefully coordinate work with all other trades and subcontractors to insure proper and adequate interface of the work of other trades and subcontractors with the work of every section of these Specifications.

B. The Contractor shall coordinate operations with all utility companies in or adjacent to the area of Contractor's work. The Contractor shall require said utilities to identify in the field their property and provide drawings as necessary to locate them.

END OF SECTION

SECTION 01055
Construction Staking

PART 1 GENERAL

1.1 SCOPE

A. Construction staking shall include all the surveying work required to layout the Work and control the location of the finished construction. The full responsibility for holding to alignment and grade shall rest upon the Contractor. All work under this Contract shall be constructed in accordance with the lines and grades on the Drawings or as given by the Engineer or Owner.

B. The Owner will provide one bench mark and a baseline adjacent to the work site. The Contractor shall be responsible for setting offsets from these points and all other layout, staking and all other surveying required for the Work.

C. The Contractor shall safeguard all points, stakes, grade marks, bench marks and monuments established on the Work, shall bear the cost of re-establishing same if disturbed and shall assume the entire expense of rectifying work improperly constructed due to failure to maintain and protect such established points, stakes and marks.

D. Measurement of quantities for payment purposes which are different from Drawing dimensions is included in the Work.

1.2 QUALITY ASSURANCE

A. The Contractor shall furnish documentation prepared by a surveyor currently registered in the State of Kentucky confirming that staking is being done to the lines and grades shown in the Contract Documents. This requires that the Contractor hire, at the Contractor's own expense, a currently registered surveyor, acceptable to the Owner, to provide ongoing confirmation of construction staking.

B. Any deviations from the Drawings shall be confirmed by the Engineer prior to construction.

C. Written certification of roadway or parking lot sub-base grades by a licensed surveyor, is required prior to paving installation.

D. Written certification of structure base grade and structure corner locations is required prior to beginning construction of the structure.

E. Quantities for payments measured under this Contract shall be certified by the approved currently registered surveyor.

PART 2 PRODUCTS

2.1 EQUIPMENT

The Contractor shall furnish and use surveying equipment and supplies maintained in good working order.

PART 3 EXECUTION

3.1 FINAL GRADES

"Blue Tops" shall be installed to control final paving subgrade. Any variance with plan grades shall be identified by the surveyor and confirmed by the Engineer prior to paving base installation.

3.2 UTILITIES

A. Staking of utilities shall be done in accordance with generally accepted practice for the type of utility involved and as specified elsewhere in these Specifications.

END OF SECTION

SECTION 01340

Shop Drawings, Product Data and Samples

PART 1 GENERAL

1.1 SCOPE

A. The work under this Section includes submittal to the Engineer of shop drawings, product data and samples required by the various sections of these Specifications.

B. Submittal Contents: The submittal contents required are specified in each section.

C. The following forms shall be used for all major components of the work:

1. Typical Maintenance Summary Form

2. Notice of Start of Manufacturing

3. Notice of Shipment of Equipment

4. Notice of Schedule Impact

The forms are included at the back of this section.

D. Definitions: Submittals are categorized as follows:

1. Shop Drawings

a. Shop drawings shall include technical data, drawings, diagrams, procedure and methodology, performance curves, schedules, templates, patterns, test reports, calculations, instructions, measurements and similar information as applicable to the specific item for which the shop drawing is prepared.

b. Provide newly-prepared information, on reproducible sheets, with graphic information at accurate scale (except as otherwise indicated) or appropriate number of prints hereof, with name or preparer (firm name) indicated. The Contract Drawings shall not be traced or reproduced by any method for use as or in lieu of detail shop drawings. Show dimensions and note which are based on field measurement. Identify materials and products in the work shown. Indicate compliance with standards and special coordination requirements. Do not allow shop drawing copies without appropriate final "Action" markings by the Engineer to be used in connection with the Work.

c. Drawings shall be presented in a clear and thorough manner. Details shall be identified by reference to sheet and detail, specification section, schedule or room numbers shown on the Contract Drawings.

d. Minimum assembly drawings sheet size shall be 24 x 36-inches.

e. Minimum detail sheet size shall be 8-1/2 x 11-inches.

f. Minimum Scale:
(1) Assembly Drawings Sheet, Scale: 1-inch = 30 feet.

(2) Detail Sheet, Scale: 1/4-inch = 1 foot.

2. Product Data

a. Product data includes standard printed information on materials, products and systems, not specially prepared for this Project, other than the designation of selections from among available choices printed therein.

b. Collect required data into one submittal for each unit of work or system, and mark each copy to show which choices and options are applicable to the Project. Include manufacturer's standard printed recommendations for application and use, compliance with standards, application of labels and seals, notation of field measurements which have been checked and special coordination requirements.

3. Samples

a. Samples include both fabricated and un-fabricated physical examples of materials, products and units of work, both as complete units and as smaller portions of units of work, either for limited visual inspection or, where indicated, for more detailed testing and analysis.

b. Provide units identical with final condition of proposed materials or products for the work. Include "range" samples, not less than three units, where unavoidable variations must be expected, and describe or identify variations between units of each set. Provide full set of optional samples where the Engineer's selection is required. Prepare samples to match the Engineer's sample where indicated. Include information with each sample to show generic description, source or product name and manufacturer, limitations and compliance with standards. Samples are submitted for review and confirmation of color, pattern, texture and "kind" by the Engineer. Engineer will note

"test" samples, except as otherwise indicated, for other requirements, which are the exclusive responsibility of the Contractor.

4. Miscellaneous submittals related directly to the Work (non-administrative) include warranties, maintenance agreements, workmanship bonds, project photographs, survey data and reports, physical work records, statements of applicability, quality testing and certifying reports, copies of industry standards, record drawings, field measurement data, operating and maintenance materials, overrun stock, security/protection/safety keys and similar information, devices and materials applicable to the Work but not processed as shop drawings, product data or samples.

1.2 SPECIFIC CATEGORY REQUIREMENTS

A. General: Except as otherwise indicated in the individual work sections, comply with general requirements specified herein for each indicated category of submittal. Submittals shall contain:

1. The date of submittal and the dates of any previous submittals.

2. The Project title.

3. Numerical submittal numbers, starting with 1.0, 2.0, etc. Revisions to be numbered 1.1, 1.2, etc.

4. The Names of:

   a. Contractor

   b. Supplier

   c. Manufacturer

5. Identification of the product, with the Specification section number, permanent equipment tag numbers and applicable Drawing No.

6. Field dimensions, clearly identified as such.

7. Relation to adjacent or critical features of the Work or materials.

8. Applicable standards, such as ASTM or Federal Specification numbers.

9. Notification to the Engineer in writing, at time of submissions, of any deviations on the submittals from requirements of the Contract Documents.

10. Identification of revisions on resubmittals.

11. An 8 x 3-inch blank space for Contractor and Engineer stamps.

12. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of products, field measurements and field construction criteria and coordination of the information within the submittal with requirements of the Work and of Contract Documents.

13. Submittal sheets or drawings showing more than the particular item under consideration shall have all but the pertinent description of the item for which review is requested crossed out.

1.3 ROUTING OF SUBMITTALS

A. Submittals and routine correspondence shall be routed as follows:

1. Supplier to Contractor (through representative if applicable)

2. Contractor to Engineer

3. Engineer to Contractor and Owner

4. Contractor to Supplier

1.4 ADDRESS FOR COMMUNICATIONS

Engineer: Haworth, Meyer & Boleyn, Inc.
3 HMB Circle
Frankfort, KY 40601
(502) 695-9800 FAX (502) 695-9810

PART 2 PRODUCTS

2.1 SHOP DRAWINGS

A. Unless otherwise specifically directed by the Engineer, make all shop drawings accurately to a scale sufficiently large to show all pertinent features of the item and its method of connection to the Work.

B. Submit all shop assembly drawings, larger than 11 x 17-inches, in the form of one reproducible transparency with two opaque prints or bluelines.

C. Submit all shop drawings, 11 x 17-inches and smaller, in the form of six opaque prints or bluelines.

D. One reproducible for all submittals larger than 11 x 17-inches and no more than three prints of other submittals will be returned to the Contractor.

2.2 MANUFACTURER'S LITERATURE

A. Where content of submitted literature from manufacturers includes data not pertinent to this submittal, clearly indicate which portion of the contents is being submitted for the Engineer's review.

B. Submit the number of copies which are required to be returned (not to exceed three) plus three copies which will be retained by the Engineer.

2.3 SAMPLES

A. Samples shall illustrate materials, equipment or workmanship and established standards by which completed work is judged.

B. Unless otherwise specifically directed by the Engineer, all samples shall be of the precise article proposed to be furnished.

C. Submit all samples in the quantity which is required to be returned plus one sample which will be retained by the Engineer.

2.4 COLORS

A. Unless the precise color and pattern is specifically described in the Contract Documents, wherever a choice of color or pattern is available in a specified product, submit accurate color charts and pattern charts to the Engineer for review and selection.

B. Unless all available colors and patterns have identical costs and identical wearing capabilities, and are identically suited to the installation, completely describe the relative costs and capabilities of each.

PART 3 EXECUTION

3.1 CONTRACTOR'S COORDINATION OF SUBMITTALS

A. Prior to submittal for the Engineer's review, the Contractor shall use all means necessary to fully coordinate all material, including the following procedures:

1. Determine and verify all field dimensions and conditions, catalog numbers and similar data.

2. Coordinate as required with all trades and all public agencies involved.

3. Submit a written statement of review and compliance with the requirements of all applicable technical Specifications as well as the requirements of this Section.

4. Clearly indicate in a letter or memorandum on the manufacturer's or fabricator's letterhead, **all deviations** from the Contract Documents.

B. Each and every copy of the shop drawings and data shall bear the Contractor's stamp showing that they have been so checked. Shop drawings submitted to the Engineer without the Contractor's stamp will be returned to the Contractor for conformance with this requirement.

C. The Owner may backcharge the Contractor for costs associated with having to review a particular shop drawing, product data or sample more than two times to receive a "No Exceptions Taken" mark.

D. Grouping of Submittals

1. Unless otherwise specifically permitted by the Engineer, make all submittals in groups containing all associated items.

2. No review will be given to partial submittals of shop drawings for items which interconnect and/or are interdependent. It is the Contractor's responsibility to assemble the shop drawings for all such interconnecting and/or interdependent items, check them and then make one submittal to the Engineer along with Contractor's comments as to compliance, non-compliance or features requiring special attention.

E. Schedule of Submittals: Within 30 days of Contract award and prior to any shop drawing submittal, the Contractor shall submit a schedule showing the estimated date of submittal and the desired approval date for each shop drawing anticipated. A reasonable period shall be scheduled for review and comments. Time lost due to unacceptable submittals shall be the Contractor's responsibility and some time allowance for resubmittal shall be provided. The schedule shall provide for submittal of items which relate to one another to be submitted concurrently.

3.2 TIMING OF SUBMITTALS

A. Make all submittals far enough in advance of scheduled dates for installation to provide all required time for reviews, for securing necessary approvals, for possible revision and resubmittal, and for placing orders and securing delivery.

B. In scheduling, allow sufficient time for the Engineer's review following the receipt of the submittal.

3.3 REVIEWED SHOP DRAWINGS

A. Engineer Review

1. Allow a minimum of 14 days for the Engineer's initial processing of each submittal requiring review and response, except allow longer periods where processing must be delayed for coordination with subsequent submittals. The Engineer will advise the Contractor promptly when it is determined that a submittal being processed must be delayed for coordination. Allow a minimum of two weeks for reprocessing each submittal. Advise the Engineer on each submittal as to whether processing time is critical to progress of the Work, and therefore the Work would be expedited if processing time could be foreshortened.

2. Acceptable submittals will be marked "No Exceptions Taken". A minimum of three copies will be retained by the Engineer for Engineer's and the Owner's use and the remaining copies will be returned to the Contractor.

3. Submittals requiring minor corrections before the product is acceptable will be marked "Make Corrections Noted". The Contractor may order, fabricate and ship the items included in the submittals, provided the indicated corrections are made. Drawings must be resubmitted for review and marked "No Exceptions Taken" prior to installation or use of products.

4. Submittals marked "Amend and Resubmit" must be revised to reflect required changes and the initial review procedure repeated.

5. The "Rejected - See Remarks" notation is used to indicate products which are not acceptable. Upon return of a submittal so marked, the Contractor shall repeat the initial review procedure utilizing acceptable products.

6. Only two copies of items marked "Amend and Resubmit" and "Rejected - See Remarks" will be reviewed and marked. One copy will be retained by

the Engineer and the other copy with all remaining unmarked copies will be returned to the Contractor for resubmittal.

B. No work or products shall be installed without a drawing or submittal bearing the "No Exceptions Taken" notation. The Contractor shall maintain at the job site a complete set of shop drawings bearing the Engineer's stamp.

C. Substitutions: In the event the Contractor obtains the Engineer's approval for the use of products other than those which are listed first in the Contract Documents, the Contractor shall, at the Contractor's own expense and using methods approved by the Engineer, make any changes to structures, piping and electrical work that may be necessary to accommodate these products.

D. Use of the "No Exceptions Taken" notation on shop drawings or other submittals is general and shall not relieve the Contractor of the responsibility of furnishing products of the proper dimension, size, quality, quantity, materials and all performance characteristics, to efficiently perform the requirements and intent of the Contract Documents. The Engineer's review shall not relieve the Contractor of responsibility for errors of any kind on the shop drawings. Review is intended only to assure conformance with the design concept of the Project and compliance with the information given in the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site. The Contractor is also responsible for information that pertains solely to the fabrication processes or to the technique of construction and for the coordination of the work of all trades.

3.4 RESUBMISSION REQUIREMENTS

A. Shop Drawings

1. Revise initial drawings as required and resubmit as specified for initial submittal, with the resubmittal number shown.

2. Indicate on drawings all changes which have been made other than those requested by the Engineer.

B. Project Data and Samples: Resubmit new data and samples as specified for initial submittal, with the resubmittal number shown.

END OF SECTION TEXT

FORMS FOLLOW

TYPICAL MAINTENANCE SUMMARY FORM

1. EQUIPMENT ITEM_____

2. MANUFACTURER_____
3. EQUIPMENT IDENTIFICATION NUMBER(S)_____

4. WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS)_____

5. NAMEPLATE DATA (hp, voltage, speed, etc.)_____

6. MANUFACTURER'S LOCAL REPRESENTATIVE

   Name_____Telephone No._____
   Address_____

7. MAINTENANCE REQUIREMENTS

Maintenance Operation	Frequency	Lubricant (If Applicable)	Comments
List briefly each maintenance operation req'd and refer to specific information in mfr's std. maintenance manual, if applicable.	List req'd frequency of each maintenance operation.	Refer by symbol to lubricant req'd.	

8. LUBRICANT LIST

Reference Symbol	Shell	Std. Oil	Gulf	Arco	Or Equal
List symbols used in Item 7. above.	List equivalent lubricants, as distributed by each Manufacturer for the specific use recommended.				

9. SPARE PARTS. Include your recommendations regarding what spare part, if any, should be kept on the job.

NOTICE OF START OF MANUFACTURING

DATE:_____

TO:_____

ATTENTION:_____

RE: Equipment Contract No._____

Name of Contract:_____

Type of Equipment:_____

Quantity:_____

Scheduled Completion of Assembly:_____

Scheduled Date of Shipment:_____

NOTE: Delay to the above schedule which will affect shipment date by 5 days or more must be reported on the Schedule Impact form.

By:_____Date:_____

Title:_____

ACTUAL MANUFACTURING AGENT:

Name:_____

Address:_____

City:_____State:_____Zip:_____Telephone:_____

NOTICE OF SHIPMENT OF EQUIPMENT

DATE:_____

TO:_____

ATTENTION:_____

RE: Equipment Contract No._____

Name of Contract:_____
Type of Equipment Being Shipped:_____

_____
QTY. DESCRIPTION (Include Equipment Numbers) SERIALS (If Applicable):

_____
_____
_____
_____
_____
ATTACH BILL(S) OF LADING FOR ALL SHIPMENTS TO THIS FORM

Date of Shipment:_____

By:_____
Title:_____
ACTUAL MANUFACTURING AGENT:

Name:_____

Address:_____

City:_____State:_____Zip:_____Telephone:_____

NOTICE OF SCHEDULE IMPACT

(Send this form to the Owner and Engineer if delay is over 5 days)

DATE:_____

TO:_____
ATTENTION:_____
RE: Equipment Contract No._____

Name of Contract:_____
Type of Equipment Affected:_____

Nature of Delay:_____
New Estimated Date for Final Shop Drawings:_____

New Estimated Date for Start of Manufacture:_____

New Estimated Date for Finish Manufacture:_____
New Estimated Date for Shipment:_____

New Estimated Date for Arrival at Jobsite:_____

By:_____
Title:_____
ACTUAL MANUFACTURING AGENT:

Name:_____

Address:_____
City:_____State:_____Zip:_____Telephone:_____

SECTION 01410
Testing Laboratory Services

PART 1 GENERAL

1.1 SCOPE

A. This Section includes testing which the Owner may require, beyond that testing required of the manufacturer, to determine if materials provided for the Project meet the requirements of these Specifications.

B. This work also includes all testing required by the Owner to verify work performed by the Contractor is in accordance with the requirements of these Specifications, i.e., concrete strength and slump testing, soil compaction, etc.

C. This work does not include materials testing required in various sections of these Specifications to be performed by the manufacturer, e.g., testing of pipe.

D. The testing laboratory or laboratories will be selected by the Contractor and approved by the Owner. The testing laboratory or laboratories will work for the Contractor subject to continual approval of the Owner.

1.2 PAYMENT FOR TESTING SERVICES

A. The cost of testing services required by the Contract to be provided by the Contractor shall be paid for by the Contractor directly, i.e., concrete testing, soil compaction, and asphalt testing.

B. The cost of additional testing services not specifically required in the Specifications, but requested by the Owner or Engineer, shall be paid for by the Owner.

C. The cost of material testing described in various sections of these Specifications or as required in referenced standards to be provided by a material manufacturer, shall be included in the price bid for that item and shall not be paid for by the Owner.

D. The cost of retesting any item that fails to meet the requirements of these Specifications shall be paid for by the Contractor. Retesting shall be performed by a testing laboratory working for the Owner.

1.3 LABORATORY DUTIES

A. Cooperate with the Owner, Engineer and Contractor.

B. Provide qualified personnel promptly on notice.

C. Perform specified inspections, sampling and testing of materials.

1. Comply with specified standards, ASTM, other recognized authorities, and as specified.

2. Ascertain compliance with requirements of the Contract Documents.

D. Promptly notify the Engineer and Contractor of irregularity or deficiency of work which are observed during performance of services.

E. Promptly submit three copies (two copies to the Engineer and one copy to the Contractor) of report of inspections and tests in addition to those additional copies required by the Contractor with the following information included:

1. Date issued

2. Project title and number

3. Testing laboratory name and address

4. Name and signature of inspector

5. Date of inspection or sampling

6. Record of temperature and weather

7. Date of test

8. Identification of product and Specification section

9. Location of Project

10. Type of inspection or test

11. Results of test

12. Observations regarding compliance with the Contract Documents

F. Perform additional services as required.

G. The laboratory is not authorized to release, revoke, alter or enlarge on requirements of the Contract Documents, or approve or accept any portion of the Work.

1.4 CONTRACTOR RESPONSIBILITIES

A. Cooperate with laboratory personnel, provide access to Work and/or manufacturer's requirements.

B. Provide to the laboratory, representative samples, in required quantities, of materials to be tested.

C. Furnish copies of mill test reports.

D. Furnish required labor and facilities to:

1. Provide access to Work to be tested;

2. Obtain and handle samples at the site;

3. Facilitate inspections and tests;

4. Build or furnish a holding box for concrete cylinders or other samples as required by the laboratory.

E. Notify the laboratory sufficiently in advance of operation to allow for the assignment of personnel and schedules of tests.

F. Laboratory Tests: Where such inspection and testing are to be conducted by an independent laboratory agency, the sample(s) shall be selected by such laboratory or agency, or the Engineer, and shipped to the laboratory by the Contractor at Contractor's expense.

G. Copies of all correspondence between the Contractor and testing agencies shall be provided to the Engineer.

1.5 QUALITY ASSURANCE

Testing shall be in accordance with all pertinent codes and regulations and with procedures and requirements of the American Society for Testing and Materials (ASTM).

1.6 PRODUCT HANDLING

Promptly process and distribute all required copies of test reports and related instructions to insure all necessary retesting or replacement of materials with the least possible delay in the progress of the Work.

1.7 FURNISHING MATERIALS

The Contractor shall be responsible for furnishing all materials necessary for testing.

1.8 CODE COMPLIANCE TESTING

Inspections and tests required by codes or ordinances or by a plan approval authority, and made by a legally constituted authority, shall be the responsibility of, and shall be paid for by the Contractor, unless otherwise provided in the Contract Documents.

1.9 CONTRACTOR'S CONVENIENCE TESTING

Inspection or testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.

1.10 SCHEDULES FOR TESTING

A. Establishing Schedule

1. The Contractor shall, by advance discussion with the testing laboratory selected by the Owner, determine the time required for the laboratory to perform its tests and to issue each of its findings, and make all arrangements for the testing laboratory to be on site to provide the required testing.

2. Provide all required time within the construction schedule.

B. When changes of construction schedule are necessary during construction, coordinate all such changes of schedule with the testing laboratory as required.

C. When the testing laboratory is ready to test according to the determined schedule, but is prevented from testing or taking specimens due to incompleteness of the Work, all extra costs for testing attributable to the delay will be back-charged to the Contractor and shall not be borne by the Owner.

1.11 TAKING SPECIMENS

Unless otherwise provided in the Contract Documents, all specimens and samples for tests will be taken by the testing laboratory or the Engineer.

1.12 TRANSPORTING SAMPLES

The Contractor shall be responsible for transporting all samples, except those taken by testing laboratory personnel, to the testing laboratory.

END OF SECTION

SECTION 01562
Dust Control

PART 1 GENERAL

1.1 SCOPE

Limit blowing dust caused by construction operations by applying water or employing other appropriate means or methods to maintain dust control, subject to the approval of the Owner. As a minimum, this may require the use of a water wagon twice a day to suppress dusty conditions.

1.2 PROTECTION OF ADJACENT PROPERTY

A. The Bidders shall visit the site and note the buildings, landscaping, roads, parking areas and other facilities near the Work site that may be damaged by their operations. The Contractor shall make adequate provision to fully protect the surrounding area and will be held fully responsible for all damages resulting from Contractor's operations.

B. Protect all existing facilities (indoors or out) from damage by dust, fumes, spray or spills (indoors or out). Protect motors, bearings, electrical gear, instrumentation and building or other surfaces from dirt, dust, welding fumes, paint spray, spills or droppings causing wear, corrosion, malfunction, failure or defacement by enclosure, sprinkling or other dust palliatives, masking and covering, exhausting or containment.

END OF SECTION

SECTION 01569
Safety in Water Works

PART 1 GENERAL

1.1 SCOPE

A. The Contractor shall be responsible for conducting all Work in a safe manner and shall take reasonable precautions to ensure the safety and protection of workers, property and the general public.

B. All construction shall be conducted in accordance with the latest applicable requirements for Part 1926 of the Occupational Safety and Health Act, Safety and Health Regulations for Construction, Section 107 of the Contract Work Hours and Safety Standards Act, as well as any other local, state or federal safety codes and regulations.

C. The Contractor shall designate a trained and qualified employee who is to be responsible for ensuring that the Work is performed safely and in conformance with all applicable regulations.

D. The Contractor shall determine the safety hazards involved in prosecuting the Work and the precautions necessary to conduct the Work safely. If the Contractor is unsure as to any special hazards which may be unique to the various processes and facilities at the treatment plant, it shall be Contractor's responsibility to determine such information prior to beginning the Work.

E. The Contractor shall bear all risks associated with performing the Work and shall fully indemnify and hold harmless the Owner and Engineer.

END OF SECTION

SECTION 01610
Transportation and Handling

PART 1 GENERAL

1.1 SCOPE

A. The Contractor shall provide transportation of all equipment, materials and products furnished under these Contract Documents to the Work site. In addition, the Contractor shall provide preparation for shipment, loading, unloading, handling and preparation for installation and all other work and incidental items necessary or convenient to the Contractor for the satisfactory prosecution and completion of the Work.

B. All equipment, materials and products damaged during transportation or handling shall be repaired or replaced by the Contractor at no additional cost to the Owner prior to being incorporated into the Work.

1.2 TRANSPORTATION

A. All equipment shall be suitably boxed, crated or otherwise protected during transportation.

B. Where equipment will be installed using existing cranes or hoisting equipment, the Contractor shall ensure that the weights of the assembled sections do not exceed the capacity of the cranes or hoisting equipment.

C. Small items and appurtenances such as gauges, valves, switches, instruments and probes which could be damaged during shipment shall be removed from the equipment prior to shipment, packaged and shipped separately. All openings shall be plugged or sealed to prevent the entrance of water or dirt.

1.3 HANDLING

A. All equipment, materials and products shall be carefully handled to prevent damage or excessive deflections during unloading or transportation.

B. Lifting and handling drawings and instructions furnished by the manufacturer or supplier shall be strictly followed. Eyebolts or lifting lugs furnished on the equipment shall be used in handling the equipment. Shafts and operating mechanisms shall not be used as lifting points. Spreader bars or lifting beams shall be used when the distance between lifting points exceeds that permitted by standard industry practice.

C. Under no circumstances shall equipment or products such as pipe, structural steel, castings, reinforcement, lumber, piles, poles, etc., be thrown or rolled off of trucks onto the ground.

D. Slings and chains shall be padded as required to prevent damage to protective coatings and finishes.

END OF SECTION

SECTION 01611
Storage and Protection

PART 1 GENERAL

1.1 SCOPE

The work under this Section includes, but is not necessarily limited to, the furnishing of all labor, tools and materials necessary to properly store and protect all materials, equipment, products and the like, as necessary for the proper and complete performance of the Work.

1.2 STORAGE AND PROTECTION

A. Storage

1. Maintain ample way for foot traffic at all times, except as otherwise approved by the Engineer.

2. All property damaged by reason of storing of material shall be properly replaced at no additional cost to the Owner.

3. Packaged materials shall be delivered in original unopened containers and so stored until ready for use.

4. All materials shall meet the requirements of these Specifications at the time that they are used in the Work.

5. Store products in accordance with manufacturer's instructions.

B. Protection

1. Use all means necessary to protect the materials, equipment and products of every section before, during and after installation and to protect the installed work and materials of all other trades.

2. All materials shall be delivered, stored and handled to prevent the inclusion of foreign materials and damage by water, breakage or other causes.

3. Substantially constructed weathertight storage sheds with raised floors shall be provided and maintained as may be required to protect adequately those materials and products stored on the site which may require protection from damage by the elements.

C. Replacements: In the event of damage, immediately make all repairs and replacements necessary for the approval of the Engineer and at no additional cost to the Owner.

D. All equipment shall be boxed, crated or otherwise completely enclosed and protected during shipment, handling and storage. All equipment shall be protected from exposure to the elements and shall be kept thoroughly dry at all times. Compressors, blowers, pumps, motors, valves, control panels, instrumentation, electrical equipment and other equipment having antifriction or sleeve bearings shall be stored in weathertight warehouses which are maintained at a temperature of at least 60 degrees F. Other equipment may be stored outside under cover. All equipment shall be stored above ground level and adequately supported on wood blocking or other approved support material. Printed storage instructions of the manufacturers shall be strictly adhered to.

E. Painted, anodized or otherwise coated surfaces shall be protected against impact, abrasion, discoloration and other damage. All coated surfaces which are damaged prior to acceptance of equipment shall be cleaned and coated to the satisfaction of the Engineer with the same or equivalent coating used in the original application.

F. Flanged openings on equipment shall be covered with suitable solid wooden or metal blanks securely bolted to the flange using a minimum of four bolts and a suitable rubber gasket. Ends of threaded pipe and fittings shall be sealed watertight with metal or plastic caps. Threaded openings shall be sealed watertight with metal or plastic plugs. Other openings shall be sealed with two layers of 6 mil polyethylene securely taped in place with waterproof tape.

G. After storage, rubber parts such as valve seats, diaphragms, expansion joints, gaskets, hoses and shaft couplings shall be checked for hardening or cracking. Deteriorated parts shall be replaced prior to start-up by the Contractor at Contractor's own expense.

H. Tarps and other coverings shall be supported above the stored equipment or materials on wooden strips to provide ventilation under the cover and minimize condensation. Tarps and covers shall be arranged to prevent ponding of water.

END OF SECTION

SECTION 01630
Substitutions and Options

PART 1 GENERAL

1.1 SCOPE

This Section outlines the restrictions and requirements for substitutions, product and manufacturer options, and construction method options.

1.2 DEFINITIONS

A. For the purposes of these Contract Documents, a "substitute item" shall be defined as one of the following:

1. A product or manufacturer offered as a replacement to a specified product or manufacturer.

2. A product or manufacturer offered in addition to a specified product or manufacturer.

B. For the purposes of these Contract Documents, a "substitute construction method" shall be defined as one of the following:

1. A mean, method, technique, sequence or procedure of construction offered as a replacement for a specified mean, method, technique, sequence or procedure of construction.

2. A mean, method, technique, sequence or procedure of construction offered in addition to a specified mean, method, technique, sequence or procedure of construction.

1.3 GENERAL

A. An item or construction method, which is offered where no specific product, manufacturer, mean, method, technique, sequence or procedure of construction is specified or shown on the Drawings, shall not be considered a substitute and shall be at the option of the Contractor, subject to the provisions in the Contract Documents for that item or construction method.

B. For products specified only by a referenced standard, the Contractor may select any product by any manufacturer, which meets the requirements of the Specifications, unless indicated otherwise in the Contract Documents.

C. If the manufacturer is named on the Drawings or in the Specifications as an acceptable manufacturer, products of that manufacturer meeting all requirements of the Specifications and Drawings are acceptable.

D. Whenever the Engineer's design is based on a specific product of a particular manufacturer, that manufacturer will be shown on the Drawings and/or listed first in the list of approved manufacturers in the Specifications. Any Bidder intending to furnish products of other than the first listed manufacturer, or furnish substitute items, shall

1. Verify that the item being furnished will fit in the space allowed, perform the same functions and have the same capabilities as the item specified.

2. Include in its Bid the cost of all accessory items which may be required by the other listed substitute product,

3. Include the cost of any architectural, structural, mechanical, piping, electrical or other modifications required, and

4. Include the cost of required additional work by the Engineer, if any, to accommodate the item.

1.4 APPROVALS

A. Approval, of a substitution as an acceptable manufacturer, of the Engineer is dependent on determination that the product offered

1. is essentially equal in function, performance, quality of manufacture, ease of maintenance, reliability, service life and other criteria to that on which the design is based, and

2. will require no major modifications to structures, electrical systems, control systems or piping systems.

1.5 SUBSTITUTIONS AND OPTIONS

A. See Bid Schedule for allowance of substitutions.

B. After Notice to Proceed

1. Substitute items will be considered for acceptable manufacturers in the Specification.

2. Where items are specified by referenced standard or specified as indicated in Article 1.3, Paragraph A. above, such items shall be submitted to the Engineer for review.

3. The Contractor shall submit shop drawings on the substitute item for the Engineer's review in accordance with the Section 01340.

C. Prior to Opening of Bids

1. No consideration or approvals will be made for products specified by a referenced standard, or specified as indicated in Article 1.3, Paragraph A. above. Such consideration may occur only after the Notice to Proceed.

2. No consideration or approvals will be made for products being offered where the term "equal to" precedes the name of an approved product. Such substitution consideration may occur only after the Notice to Proceed.

END OF SECTION

SECTION 01640
General Equipment Stipulations

PART 1 GENERAL

1.1 SCOPE

These general equipment stipulations apply, in general, to all equipment and piping. They supplement the detailed equipment Specifications, but in case of conflict, the detailed equipment Specifications shall govern.

1.2 COORDINATION

The Contractor shall assume full responsibility for the coordination of the installation of all equipment, materials and products furnished under these Contract Documents. The Contractor shall be completely responsible for verification that all structures, piping and equipment components furnished by the Contractor and/or subcontractors and suppliers are compatible. The Contractor shall start-up each equipment system and shall make all necessary alterations. All such alterations shall be made at the Contractor's expense.

1.3 ADAPTATION AND LOCATION OF EQUIPMENT

A. No responsibility for alteration of a planned structure to accommodate other types of equipment will be assumed by the Owner. Equipment which requires alteration of the structures will be considered only if the Contractor assumes all responsibility for making and coordinating all necessary alterations. All such alterations shall be made at the Contractor's expense.

1.4 PATENT ROYALTIES

All royalties and fees for patents covering materials, articles, apparatus, devices or equipment shall be included in prices Bid by the Contractor.

1.5 EQUIPMENT WARRANTY

The Contractor shall warrant all equipment against faulty or inadequate design, improper assembly or erection, defective materials, breakage or other failure. The warranty period shall be defined in Section 01740 of these Specifications.

1.6 WORKMANSHIP AND MATERIALS

A. All equipment shall be designed, fabricated and assembled in accordance with the most modern engineering and shop practice. Individual parts shall be manufactured to standard sizes and gauges so that repair parts, furnished at any

time, can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall be new and shall not have been in service at any time prior to delivery, except as required by tests.

B. Materials shall be suitable for service conditions. Iron castings shall be tough, close grained, gray iron free from blowholes, flaws or excessive shrinkage and shall conform to ASTM A 48, Class 30 minimum. Plugging of defective castings shall not be permitted. Castings shall be annealed to remove internal stresses prior to machining and shall have the mark number and heat number cast on them.

C. Except where otherwise specified, structural and miscellaneous fabricated steel used in items of equipment shall conform to the Standards of the American Institute of Steel Construction. All structural members shall be considered as subject to shock or vibratory loads.

1.7 LUBRICATION AND LUBRICATION FITTINGS (Not Used)

1.8 SAFETY GUARDS (Not Used)

1.9 EQUIPMENT BASES (Not Used)

1.10 ALIGNMENT OF MOTORS AND EQUIPMENT (Not Used)

1.11 GROUTING (Not USed)

1.12 WELDING AND BRAZING

A. All welds shall be sound and free from embedded scale and slag. All butt welds shall be continuous, and where exposed to view, shall be ground smooth. All continuous welds shall be gas and liquid-tight. Welds in piping shall have full penetration and shall be smooth on the inside of the pipe. Intermittent welds shall have an effective length of at least 2-inches and shall be spaced not more than 6-inches apart.

B. All welding of steel and aluminum, including materials, welding techniques, general safety practices, appearance and quality of welds, and methods of correcting defective work, shall conform to the latest requirements of AWS Specifications. Structural steel welding shall conform to the requirements of the AWS Structural Welding Code. The general recommendations and requirements of the AWS Structural Welding Code shall also apply to welded aluminum structures. The welding process and welding operators shall meet qualification tests and welding performance tests in accordance with the latest provisions of ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Qualifications. Welding process and qualification procedures for welding of pipe shall conform to the latest requirements of ANSI B31.1, Section 327, Welding,

and Section 328, Brazing and Soldering. All welding qualification tests shall be witnessed by the Engineer, except as provided herein. All costs associated with the qualification or testing of welders and welding operators shall be borne by the Contractor.

C. Reports certifying that the welding procedures, welders and welding operators that the Contractor intends to use meet the requirements specified above. These reports shall be submitted to the Engineer prior to beginning the Work. In the case of welder qualifications for shop welding and for carbon steel field welding, welders presenting certified qualification papers validated within the preceding six month period will not be required to take the qualification tests. In the case of field welding of stainless steel or aluminum, all welders shall be required to take the qualification tests regardless of past experience or availability of certified qualification papers.

D. Field welding practices shall conform to OSHA construction standards, Part 1926, Subpart J, Welding and Cutting. Shop welding practices shall conform to OSHA General Industry Standards, Part 1910, Subpart Q, Welding, Cutting, and Brazing.

E. Welding electrodes for structural steel shall conform to the standard recommendations of the AISC. Welding electrodes for stainless steel shall conform to applicable AWS Specifications and shall be as recommended by "Welded Austenitic Chromium-Nickel Stainless Steels, Techniques and Properties", published by the International Nickel Company, New York, New York. Welding electrodes for aluminum shall conform to applicable AWS Specifications.

F. Each welder and welding operator must identify all welds with welder's assigned symbol.

G. Welders performing unsatisfactory work shall be removed from the welding process.

H. The Owner may inspect any weld by radiographic or other means. Welds not in accordance with the requirements specified herein shall be repaired or replaced at the Contractor's expense. Excessive porosity, nonmetallic inclusions, lack of fusion, incomplete penetration and cracking shall constitute grounds for rejection of welds.

1.13 ERECTION AND SETTING

A. In the erection and setting of all fabricated equipment, the Contractor shall exercise care to ensure that each item of equipment is adequately supported so as not to bend or distort under its own weight until adequate foundation support and anchorage are provided. Where lifting lugs, angles or clips are provided on

equipment, they shall be used in erecting and setting the equipment. Erection and setting of equipment and structural steel shall conform to the requirements of OSHA Construction Standards, Part 1926, Subpart R, Steel Erection, Subpart H, Material Handling, Storage, Use, and Disposal, and Subpart N, Cranes, Derricks, Hoists, and Conveyors. Erection of structural steel shall conform to the latest requirements of the AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings.

B. During placement and prior to any grouting or connection of adjacent piping, the equipment shall be leveled and aligned true to level, plumb, alignment and grade with all parts bearing or fitting the structure or equipment accurately and securely. It shall not be permitted to cock out of alignment, nor shall the Contractor redrill, reshape or force fit any fabricated items.

C. The Contractor shall take all measurements necessary to properly fit Contractor's work in the field, and Contractor shall be governed by and responsible for these measurements and the proper working out of all details. The Contractor shall be responsible for the correct fitting of all work in the field and the accurate placement of all anchor bolts installed by Contractor.

D. The Contractor shall bring all parts to be erected or assembled into close contact. Before assembly, all surfaces to be in contact with each other shall be thoroughly cleaned. Drift pins may be used only for bringing members into position, never to enlarge or distort holes. Torching or burning of holes or cutting of fabricated items to correct misalignment or shop errors shall not be permitted. Enlargement of holes necessary to make field connections shall be done only with the Engineer's approval by reaming with twist drills and in a manner acceptable to Engineer.

E. All equipment shall be furnished with suitable eyebolt lifting lugs or lifting angles to facilitate handling.

1.14 SPECIAL TOOLS AND ACCESSORIES

A. Equipment requiring periodic repair and adjustment shall be furnished complete with all special tools, instruments and accessories required for proper maintenance. Special tools and accessories shall include those tools and accessories not normally available in an industrial hardware or mill supply house. Equipment requiring special devices for lifting or handling shall be furnished complete with those devices.

1.15 SHOP PRIMING AND PAINTING (Not Used)

1.16 FIELD PRIMING (Not Used)

1.17 FIELD PAINTING (Not Used)

1.18 GALVANIZING

A. All galvanizing shall be done by the hot-dip process after fabrication in conformity with requirements of ASTM A 123, A 153, A 384 and A 385. Articles to be galvanized shall be pickled before galvanizing.

B. Where galvanized bolts are specified or required by the Drawings, cadmium or zinc plated bolts will be acceptable provided cadmium plating conforms to ASTM A 165, Type NS and zinc plating conforms to ASTM A 164, Type GS.

C. Areas of galvanizing damaged by welding or burning or otherwise damaged shall be thoroughly stripped and cleaned and recoated with zinc to the required thickness by the hot dip process.

D. Galvanized articles shall be free from uncoated spots, blisters, flux, black spots, dross, projections and other defects not consistent with acceptable galvanizing practice.

E. Zinc and cadmium plating shall be subject to visual examination to determine uniformity of coating. The Engineer may require that the coating uniformity be tested in accordance with ASTM A 239.

1.19 PROTECTION AND STORAGE

A. All equipment shall be boxed, crated or otherwise completely enclosed and protected during shipment, handling and storage. All equipment shall be protected from exposure to the elements and shall be kept thoroughly dry at all times.

B. Painted, anodized or otherwise coated surfaces shall be protected against impact, abrasion, discoloration and other damage. All coated surfaces which are damaged prior to acceptance of equipment shall be cleaned and coated to the satisfaction of the Engineer with the same or equivalent coating used in the original application.

C. Flanged openings on equipment shall be covered with suitable solid wooden or metal blanks securely bolted to the flange using a minimum of four bolts and a suitable rubber gasket. Ends of threaded pipe and fittings shall be sealed watertight with metal or plastic caps. Threaded openings shall be sealed watertight with metal or plastic plugs. Other openings shall be sealed with two layers of 6 mil polyethylene securely taped in place with waterproof tape.

D. After storage, rubber parts such as valve seats, diaphragms, expansion joints, gaskets, hoses and shaft couplings shall be checked for hardening or cracking. Deteriorated parts shall be replaced prior to start-up by the Contractor at Contractor's own expense.

1.20 VIBRATION TESTING (Not Used)

1.21 HYDRAULIC SYSTEMS (Not Used)

1.22 NOISE CRITERIA (Not Used)

1.23 INSTALLATION CHECK (Not Used)

1.24 FIELD TESTING (Not Used)

1.25 IDENTIFICATION OF PIPING AND EQUIPMENT (Not Used)

1.26 SAFETY SIGNS (Not Used)

END OF SECTION

SECTION 01710
Cleaning

PART 1 GENERAL

1.1 SCOPE

This Section covers the general cleaning which the Contractor shall be required to perform both during construction and before final acceptance of the Project unless otherwise shown on the Drawings or specified elsewhere in these Specifications.

1.2 QUALITY ASSURANCE

A. Daily, and more often if necessary, conduct inspections verifying that requirements of cleanliness are being met.

B. In addition to the standards described in this Section, comply with all pertinent requirements of governmental agencies having jurisdiction.

1.3 HAZARDOUS MATERIAL AND WASTE

A. The Contractor shall handle hazardous waste and materials in accordance with applicable local, state, and federal regulations. Waste shall also be disposed of in WFPA approved landfills as applicable.

B. The Contractor shall prevent accumulation of wastes which create hazardous conditions.

C. Burning or burying rubbish and waste materials on the site shall not be allowed.

D. Disposal of hazardous wastes or materials into sanitary or storm sewers shall not be allowed.

1.4 DISPOSAL OF SURPLUS MATERIALS

Unless otherwise shown on the Drawings, specified or directed, the Contractor shall legally dispose off the site all surplus materials and equipment from demolition and shall provide suitable off-site disposal site, or utilize a site designated by the Owner.

PART 2 PRODUCTS

2.1 CLEANING MATERIALS AND EQUIPMENT

Provide all required personnel, equipment and materials needed to maintain the specified standard of cleanliness.

2.2 COMPATIBILITY

Use only the cleaning materials, methods and equipment which are compatible with the surface being cleaned, as recommended by the manufacturer of the material or as approved by the Engineer.

PART 3 EXECUTION

3.1 PROGRESS CLEANING

A. General

1. Do not allow the accumulation of scrap, debris, waste material and other items not required for construction of this Work.

2. At least each week, and more often if necessary, completely remove all scrap, debris and waste material from the job site.

3. Provide adequate storage for all items awaiting removal from the job site, observing all requirements for fire protection and protection of the environment.

B. Site

1. Daily, and more often if necessary, inspect the site and pick up all scrap, debris and waste material. Remove all such items to the place designated for their storage.

2. Restack materials stored on site weekly.

3. At all times maintain the site in a neat and orderly condition which meets the approval of the Engineer.

C. Structures

1. Weekly, and more often if necessary, inspect the structures and pick up all scrap, debris and waste material. Remove all such items to the place designated for their storage.

2. Weekly, and more often if necessary, sweep all interior spaces clean. "Clean", for the purpose of this subparagraph, shall be interpreted as meaning free from dust and other material capable of being removed by using a hand-held broom.

3. As required preparatory to installation of successive materials, clean the structures or pertinent portions as recommended by the manufacturer of the successive material.

4. Following the installation of finish floor materials, clean the finish floor daily. "Clean", for the purpose of this paragraph, shall be interpreted as meaning free from all foreign material which, in the opinion of the Engineer, may be injurious to the finish floor material.

5. Schedule cleaning operation so that dust and other contaminants resulting from cleaning operations will not fall on wet, recently painted surfaces.

3.2 FINAL CLEANING

A. Definitions: Unless otherwise specifically specified, "clean" for the purpose of this Article shall be interpreted as the level of cleanliness generally provided by commercial building maintenance subcontractors using commercial quality building maintenance equipment and materials.

B. General: Prior to completion of the Work, remove from the job site all tools, surplus materials, equipment, scrap, debris and waste. Conduct final progress cleaning as described in 3.01 above.

C. Site: Unless otherwise specifically directed by the Engineer, hose down all paved areas on the site and all public sidewalks directly adjacent to the site; rake clean other surfaces of the grounds. Completely remove all resultant debris.

D. Structures

1. Remove all traces of soil, waste material, splashed material, and other foreign matter to provide a uniform degree of exterior cleanliness. Visually inspect all exterior surfaces and remove all traces of soil, waste material, and other foreign matter. Remove all traces of splashed materials from adjacent surfaces. If necessary to achieve a uniform degree of exterior cleanliness, hose down the exterior of the structure. In the event of

stubborn stains not removable with water, the Engineer may require light sandblasting or other cleaning at no additional cost to the Owner.

2. Visually inspect all interior surfaces and remove all traces of soil, waste material, smudges and other foreign matter. Remove all paint droppings, spots, stains and dirt from finished surfaces.

3. Clean all glass inside and outside.

4. Polish all surfaces requiring the routine application of buffed polish. Provide and apply polish as recommended by the manufacturer of the material being polished.

E. Post-Construction Cleanup: All evidence of temporary construction facilities, haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, or any other evidence of construction, as directed by the Engineer.

F. Restoration of Landscape Damage: Any landscape feature damaged by the Contractor shall be restored as nearly as possible to its original condition at the Contractor's expense. The Engineer will decide what method of restoration shall be used.

G. Timing: Schedule final cleaning as approved by the Engineer to enable the Owner to accept the Project.

3.3 CLEANING DURING OWNER'S OCCUPANCY

Should the Owner occupy the Work or any portion thereof prior to its completion by the Contractor and acceptance by the Owner, responsibilities for interim and final cleaning of the occupied spaces shall be as determined by the Engineer in accordance with the Supplementary Conditions of the Contract Documents.

END OF SECTION

SECTION 01720
Record Documents

PART 1 GENERAL

1.1 SCOPE

A. The work under this Section includes, but is not necessarily limited to, the compiling, maintaining, recording and submitting of project record documents as herein specified.

B. Record documents include, but are not limited to:

1. Drawings;

2. Specifications;

3. Change orders and other modifications to the Contract;

4. Engineer field orders or written instructions, including Requests for Information (RFI) and Clarification Memorandums;

5. Reviewed shop drawings, product data and samples;

6. Test records.

C. The Contractor shall maintain on the Project site throughout the Contract Time an up to date set of Record Drawings.

1.2 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. Storage

1. Store documents and samples in the Contractor's field office, apart from documents used for construction.

2. Provide files and racks for storage of documents.

3. Provide locked cabinet or secure storage space for storage of samples.

B. File documents and samples in accordance with format of these Specifications.

C. Maintenance

1. Maintain documents in a clean, dry, legible condition and in good order.

2. Do not use record documents for construction purposes.

3. Maintain at the site for the Owner one copy of all record documents.

D. Make documents and samples available at all times for inspection by Engineer.

E. Failure to maintain the Record Documents in a satisfactory manner may be cause for withholding of a certificate for payment.

1.3 QUALITY ASSURANCE

A. Unless noted otherwise, Record Drawings shall provide dimensions, distances and coordinates to the nearest 0.1 foot.

B. Unless noted otherwise, Record Drawings shall provide elevations to the nearest 0.01 foot for all pertinent items constructed by the Contractor.

1.4 RECORDING

A. Label each document "PROJECT RECORD" in neat, large printed letters.

B. Recording

1. Record information concurrently with construction progress.

2. Do not conceal any work until required information is recorded.

1.5 RECORD DRAWINGS

A. Record Drawings shall be reproducible, shall have a title block indicating that the drawings are Record Drawings, the name of the company preparing the Record Drawings, and the date the Record Drawings were prepared. The Contractor will be provided paper sepias of the Drawings, or it may elect to provide reproducible drawings via another method. Reproducible shall be defined as being translucent so as to allow a blueline print to be produced.

B. Legibly mark drawings to record actual construction, including:

1. All Construction

a. Changes of dimension and detail.

b. Changes made by Requests for Information (RFI), field order, clarification memorandums or by change order.

c. Details not on original Drawings.

2. Site Improvements, Including Underground Utilities

a. Horizontal and vertical locations of all exposed and underground utilities and appurtenances, both new facilities constructed and those utilities encountered, referenced to permanent surface improvements.

b. Location of and dimensions of roadways and parking areas, providing dimensions to back of curb when present.

c. The locations shall be referenced to at least two easily identifiable, permanent landmarks (e.g., power poles, valve markers, etc.) or benchmarks.

d. The Record Drawings shall include the horizontal angle and distance between manhole covers.

3. Structures

a. Depths of various elements of foundation in relation to finish first floor datum or top of wall.

b. Location of internal and buried utilities and appurtenances concealed in the construction, referenced to visible and accessible features of the structure.

1.6 SPECIFICATIONS

A. Legibly mark each section to record:

1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.

2. Changes made by Requests for Information (RFI), field order, clarification memorandums, or by change order.

1.7 SUBMITTAL

A. At contract closeout, deliver Record Documents to the Engineer for the Owner.

B. Accompany submittal with transmittal letter, in duplicate, containing:

1. Date

2. Project title and number

3. Contractor's name and address

4. Title and number of each record document

5. Signature of Contractor or Contractor's authorized representative

END OF SECTION

SECTION 01740
Warranties and Bonds

PART 1 GENERAL

1.1 PROJECT MAINTENANCE AND WARRANTY

A. Maintain and keep in good repair the Work covered by these Drawings and Specifications until acceptance by the Owner.

B. The Contractor shall warrant for a period of one year from the date of Owner's written acceptance of certain segments of the Work and/or Owner's written final acceptance of the Project, as defined in the Contract Documents, that the completed Work is free from all defects due to faulty products or workmanship and the Contractor shall promptly make such corrections as may be necessary by reason of such defects. The Owner will give notice of observed defects with reasonable promptness. In the event that the Contractor should fail to make such repairs, adjustments or other work that may be made necessary by such defects, the Owner may do so and charge the Contractor the cost thereby incurred. The Performance Bond shall remain in full force and effect throughout the warranty period.

C. The Contractor shall not be obligated to make replacements which become necessary because of ordinary wear and tear, or as a result of improper operation or maintenance, or as a result of improper work or damage by another Contractor or the Owner, or to perform any work which is normally performed by a maintenance crew during operation.

D. In the event of multiple failures of major consequences prior to the expiration of the one year warranty described above, the affected unit shall be disassembled, inspected and modified or replaced as necessary to prevent further occurrences. All related components which may have been damaged or rendered non-serviceable as a consequence of the failure shall be replaced. A new 12 month warranty against defective or deficient design, workmanship, and materials shall commence on the day that the item is reassembled and placed back into operation. As used herein, multiple failure shall be interpreted to mean two or more successive failures of the same kind in the same item or failures of the same kind in two or more items. Major failures may include, but are not limited to, cracked or broken housings, piping, or vessels, excessive deflections, bent or broken shafts, broken or chipped gear teeth, premature bearing failure, excessive wear or excessive leakage around seals. Failures which are directly and clearly traceable to operator abuse, such as operations in conflict with published operating procedures or improper maintenance, such as substitution of unauthorized replacement parts, use of incorrect lubricants or chemicals, flagrant over-or under-lubrication and using maintenance procedures not conforming with

published maintenance instructions, shall be exempted from the scope of the one year warranty. Should multiple failures occur in a given item, all products of the same size and type shall be disassembled, inspected, modified or replaced as necessary and rewarranted for one year.

E. The Contractor shall, at Contractor's own expense, furnish all labor, materials, tools and equipment required and shall make such repairs and removals and shall perform such work or reconstruction as may be made necessary by any structural or functional defect or failure resulting from neglect, faulty workmanship or faulty materials, in any part of the Work performed by the Contractor. Such repair shall also include refilling of trenches, excavations or embankments which show settlement or erosion after backfilling or placement.

F. Except as noted on the Drawings or as specified, all structures such as embankments and fences shall be returned to their original condition prior to the completion of the Contract. Any and all damage to any facility not designated for removal, resulting from the Contractor's operations, shall be promptly repaired by the Contractor at no cost to the Owner.

G. The Contractor shall be responsible for all road and entrance reconstruction and repairs and maintenance of same for a period of one year from the date of final acceptance. In the event the repairs and maintenance are not made immediately and it becomes necessary for the owner of the road to make such repairs, the Contractor shall reimburse the owner of the road for the cost of such repairs.

H. In the event the Contractor fails to proceed to remedy the defects upon notification within 15 days of the date of such notice, the Owner reserves the right to cause the required materials to be procured and the work to be done, as described in the Drawings and Specifications, and to hold the Contractor and the sureties on Contractor's bond liable for the cost and expense thereof.

I. Notice to Contractor for repairs and reconstruction will be made in the form of a registered letter addressed to the Contractor at Contractor's home office.

J. Neither the foregoing paragraphs nor any provision in the Contract Documents, nor any special guarantee time limit implies any limitation of the Contractor's liability within the law of the place of construction.

END OF SECTION

SECTION 02010
Subsurface Conditions

PART 1 GENERAL

1.1 DESCRIPTION

A. Soil boring logs are shown in the geotechnical report. This report is included as Appendix A of these specifications, additional copies of this report may be obtained upon request at the office of HMB, Inc.

B. This soil investigation information is offered as an aid in bidding only and is not a part of the Contract Documents. The boring logs are available for the Contractor's information, but are not a warranty of subsurface conditions. The Owner, Engineer and geotechnical engineer assume no responsibility for any variation between materials encountered during construction and those indicated on the boring logs, nor for any variation between the location of the water table encountered and that indicated on the boring logs at the date borings were taken.

C. Additional Investigation: The Contractor shall visit the site and become acquainted with site conditions. Prior to bidding, prospective Contractors may make their own site and subsurface investigations to satisfy themselves with site and subsurface conditions. The Contractor shall be responsible for obtaining rights of ingress and egress to private property for site and subsurface investigation and shall assume all responsibility for any damage to property caused as a result of the Contractor's investigation.

D. Location of Borings: Contractors shall be responsible for making their own determination of the location of the soil borings on this Project.

E. The Contractor shall retain the services of the Geotechnical consultant to verify the adequacy of the bearing stratum after the Contractor has carried out the excavation and before any concrete or reinforcement is placed. The concrete foundation shall be designed by the Contractor based upon the recommendations in the Geotechnical report.

END OF SECTION

SECTION 02100
Site Preparation

PART 1 GENERAL

1.1 SCOPE

A. This Section describes materials and equipment to be utilized and requirements for their use in preparing the work site for construction. The Contractor shall furnish all materials, equipment and labor necessary to complete the work.

B. Comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, state or federal authorities having jurisdiction.

1.2 CLEARING AND GRUBBING

A. Within the limits shown on the Drawings, the site will be cleared and grubbed to prepare for construction.

B. Clearing

1. All vegetable growth such as trees, shrubs, brush, logs, upturned stumps and roots of down trees, and other similar items shall be removed and disposed of properly by the Contractor as specified below. Cultivated growth shall be removed and trees felled as necessary within the construction work site and as indicated.

2. Where the tree limb structure interferes with utility wires, or where the trees to be felled are in close proximity to utility wires, the tree shall be taken down in sections to eliminate the possibility of damage to the appropriate utility.

3. All buildings, fences, lumber piles, trash and obstructions, except utility poles, shall be removed and disposed of by the Contractor. Any work pertaining to utility poles shall comply with the requirements of the appropriate utility.

4. All fences adjoining any excavation or embankment that may be damaged or buried shall be carefully removed, stored and replaced.

C. All stumps, roots, foundations and planking embedded in the ground shall be removed and disposed of properly by the Contractor as specified below. Piling and butts of utility poles shall be removed to a minimum depth of two feet below the limits of excavation for structures, trenches and roadways or two feet below finish grade, whichever is lower.

1.3 PRELIMINARY GRADING

A. Before beginning construction, the Contractor shall grade the entire work site to conform, in general, to the finish elevations shown on the Drawings. The Drawings show both existing contour elevations and finished contour elevations.

1.4 TESTING AND INSPECTION SERVICES

A. Soil testing will be performed by an independent testing laboratory selected by the Contractor and approved for by the Owner. The Contractor will be responsible for all cost associated with the required soil testing.

B. The soils testing laboratory is responsible for the following:

1. Compaction tests in accordance with ASTM D 698.

2. Field density tests for each two feet of lift; one test for each 5,000 square feet of fill.

3. Inspecting and testing stripped site, subgrades and proposed fill materials.

C. The Contractor's duties relative to testing include:

1. Notifying the laboratory of conditions requiring testing.

2. Coordinating with the laboratory for field testing.

3. Providing representative fill soil samples to laboratory for test purposes. Provide 50 pound samples of each fill soil.

4. Paying costs for additional testing performed beyond the scope of that required and for retesting where initial tests reveals non-conformance with specified requirements.

D. Inspection

1. Earthwork operations, suitability of excavated materials for fill and backfill, and placing and compaction of fill and backfill is subject to inspection. The Engineer will observe earthwork operations.

2. Foundations and shallow spread footing foundations are required to be inspected by a geotechnical engineer to verify suitable bearing and construction.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 PREPARATION

A. Maintain bench marks, monuments and other reference points. Re-establish, at no cost to the Owner, any such reference points if disturbed or destroyed.

3.2 CLEARING

A. Clear areas required for access to site and execution of the work.

B. Remove trees and shrubs within the area to be cleared.

C. Clear undergrowth and deadwood, without disturbing subsoil.

3.3 DISPOSAL OF REFUSE

A. The refuse resulting from the clearing and grubbing operation shall be hauled to a disposal site secured by the Contractor and shall be disposed of in accordance with all requirements of federal, state, county and municipal regulations. No debris of any kind shall be deposited in any stream or body of water, or in any street or alley. No debris shall be deposited upon any private property except by written consent of the property owner. In no case shall any material be left on the Project, shoved onto abutting private properties, or be buried in embankments or trenches on the Project.

B. When approved in writing by the Engineer, and when authorized by the proper authorities, the Contractor may dispose of such refuse by burning on the site of the Project provided all requirements set forth by the authorities are met. The authorization to burn shall not relieve the Contractor in any way from damages which may result from Contractor's operations. On easements through private property, the Contractor shall not burn on the site.

END OF SECTION

SECTION 02140

Dewatering

PART 1 GENERAL

1.1 SCOPE

A. This Section shall apply to all excavation, except trench excavation.

B. Construct all permanent work in areas free from water. Design, construct and maintain all dikes, levees, cofferdams and diversion and drainage channels as necessary to maintain the areas free from water and to protect the areas to be occupied by permanent work from water damage. Remove temporary works after they have served their purpose.

C. The Contractor shall be responsible for the stability of all temporary and permanent slopes, grades, foundations, materials and structures during the course of the Contract. Repair and replace all slopes, grades, foundations, materials and structures damaged by water, both surface and subsurface, to the lines, grades and conditions existing prior to the damage, at no additional cost to the Owner.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 CARE OF WATER

A. Except where the excavated materials are designated as materials for permanent work, material from required excavation may be used for dikes, levees, cofferdams and other temporary backfill.

B. Furnish, install, maintain and operate necessary pumping and other equipment for dewatering the various parts of the work and for maintaining the foundation and other parts free from water as required for constructing each part of the work.

C. Install all drainage ditches, sumps and pumps to control excessive seepage on excavated slopes, to drain isolated zones with perched water tables and to drain impervious surfaces at final excavation elevation.

D. Dewater by means which will insure dry excavations, preserve final lines and grades, do not disturb or displace adjacent soil.

E. All pumping and drainage shall be done with no damage to property or structures and without interference with the rights of the public, owners of private property,

pedestrians, vehicular traffic or the work of other contractors, and in accordance with all pertinent laws, ordinances and regulations.

F. Do not overload or obstruct existing drainage facilities.

G. After they have served their purpose, remove all temporary protective work at a satisfactory time and in a satisfactory manner. All diversion channels and other temporary excavations in areas where the compacted fill or other structures will be constructed shall be cleaned out, backfilled and processed under the same Specifications as those governing the compacted fill.

H. When the temporary works will not adversely affect any item of permanent work or the planned usage of the Project, the Contractor may be permitted to leave such temporary works in place. In such instances, breeching of dikes, levees and cofferdams may be required.

3.2 DEWATERING

A. By the use of well points, pumps, tile drains or other approved methods, the Contractor shall prevent the accumulation of water in excavated areas. Should water accumulate, it shall be promptly removed.

B. Excavations shall be continuously dewatered to maintain a ground water level no higher than three to four feet below the lowest point in the excavation. Dewatering shall be accomplished well enough in advance of excavation to ensure that groundwater is already lowered prior to completing the final excavation to finish subgrade.

C. All destabilized subgrade conditions caused by inadequate or untimely dewatering operations shall be undercut and backfilled with suitable backfill material at no additional cost to the Owner.

D. Piezometric observation wells are required to monitor the ground water level to insure proper dewatering prior to excavation below the static water table. The number of wells required will vary depending on the size and depth of structures.

END OF SECTION

SECTION 02200
Earthwork

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of earthwork is indicated on the Drawings.

1. Preparation of subgrade for tanks, basins, building slabs, walks, and pavements is included as part of this work.

2. Engineered fill course for support of building or basin slabs is included as part of this work.

3. Backfilling of tanks, basins, basements, and trenches within building lines is included as part of this work.

B. Excavation for Mechanical/Electrical Work: Excavation and backfill required in conjunction with underground mechanical and electrical utilities, and buried mechanical and electrical appurtenances is included as work of this Section.

C. Definition: "Excavation" consists or removal of all material encountered to subgrade elevations indicated and subsequent disposal of materials removed.

1.2 QUALITY ASSURANCE

A. Codes and Standards: Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.

B. Testing and Inspection Services: Employ, at Contractor's expense, testing laboratory acceptable to the Owner to perform soil testing and inspection service for quality control testing during earthwork operations.

1.3 SUBMITTALS

A. Test Reports-Excavating

Submit following reports directly to the Engineer from the testing services, with copy to Contractor:

1. Test reports on borrow material.

2. Verification of each footing subgrade.

3. Field density test reports.

4. One optimum moisture-maximum density curve for each type of soil encountered.

5. Report of actual unconfined compressive strength and/or results of bearing tests on each strata tested.

1.4 JOB CONDITIONS

A. Site Information

1. Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil bearings. It is expressly understood that Owner will not be responsible for interpretation or conclusions drawn therefrom by Contractor. Data are made available for convenience of Contractor.

2. Additional test borings and other exploratory operations may be made by Contractor at no cost to Owner.

B. Existing Utilities: Prior to commencement of work, the Contractor shall locate existing underground utilities in areas of the work. If utilities are to remain in place, provide adequate means of protection during earthwork operations.

C. Use of Explosives: The Contractor (or any of his subcontractors) shall not bring explosives onto site or use in work without prior written permission from the Owner. All activities involving explosives shall be in compliance with the rules and regulations of the Kentucky Department of Mines and Minerals, Division of Explosives and Blasting. Contractor is solely responsible for handling, storage, and use of explosive materials when their use is permitted.

D. Protection of Persons and Property

1. Barricade open excavations occurring as part of this work and post with warning lights.

a. Operate warning lights as recommended by authorities having jurisdiction.

b. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

A. Definitions

1. Satisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, SP, GC, SC, ML and CL.

2. Unsatisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups MH, CH, OL, OH and PT.

3. Subbase Material: Naturally and artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, natural or crushed sand.

4. Drainage fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100 percent passing a 1-1/2 inch sieve and not more than 5 percent passing a No. 4 sieve.

5. Backfill and fill materials: Satisfactory soil materials free of debris, waste, frozen materials, vegetable, and other deleterious matter.

6. Engineered fill: (Refer to this Section, paragraph 3.7 A.1.)

PART 3 EXECUTION

3.1 STRIPPING AND TOPSOILING

A. Before excavation and grading is commenced for buildings, structures or other work described hereinafter (except pipelines and manholes), the material meeting the topsoil specification of these Specifications shall be removed from the areas affected and stock-piled. When final grading is accomplished, particularly around buildings and other structures, the topsoil shall be spread evenly over the excavated area. Rough grading above excavated areas shall have been carried approximately 6 inches below finished grade (except solid rock, where it shall be carried 12 inches below finished grade) and brought back up to grade with topsoil as set out herein.

3.2 EXCAVATION

A. Excavation includes excavation to subgrade elevations indicated including excavation of earth, rock, bricks, wood, cinders, and other debris. All excavation of materials in the lump sum portion of the work will be unclassified and no additional payment will be made regardless of type material encountered.

B. Excavation Classifications (Not Used)

C. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be at Contractor's expense.

1. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to the Engineer.

2. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of same classifications.

D. Additional Excavation

1. When excavation has reached required subgrade elevations, notify the Engineer who will make an inspection of conditions.

a. If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated material as directed in writing by the Engineer.

b. Removal of unsuitable material and its replacement as directed will be paid on basis of Contract conditions relative to changes in work.

E. Stability of Excavations

1. Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.

2. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

F. Shoring and Bracing

1. Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross-braces, in good serviceable condition.

   a. Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.

   b. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.

   c. Provide permanent steel sheet piling or pressure creosoted timber sheet piling wherever subsequent removal of sheet piling might permit lateral movement of soil under adjacent structures. Cut off tops as required and leave permanently in place. In the event the Owner directs the Contractor to leave shoring materials in place, the Owner will reimburse the Contractor for the reasonable cost of leaving such materials in place.

G. Dewatering: Refer to this Division, Section 02140 for dewatering requirements.

H. Material Storage

1. Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.

   a. Dispose of excess soil material and waste materials as herein specified.

I. Excavation for Structures

1. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 feet and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.

2. In excavating for footings and foundations, take care not to disturb bottom of excavation. All loose material shall be removed from the excavation just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive other work.

J. Excavation for Pavements

1. Cut surface under pavements to comply with cross-sections, elevations, and grades as shown.

K. Trench Excavation

1. The Contractor shall include in his lump sum bid all trenching and backfill necessary for installation of all pipelines as planned and specified. Trenching shall include clearing and grubbing of all trash, weeds, briars, trees, stumps encountered in trenching. The Contractor shall dispose of such material at no extra cost to the Owner. Shrubs shall be removed, maintained and replanted in the same or adjacent location as the Engineer may direct. Trenching also included such items as railroad, street, road, sidewalk, pipe, and small creek crossings; cutting, moving or repairing damage to fences, posts, gates, and other surface structures regardless of whether shown on the Drawings.

2. All existing facilities shall be protected from danger or damage while pipelines are being constructed and backfilled, and from damage due to settlement of the backfill.

3. In the event any existing structure is damaged, repair and restoration shall be made at once and backfill shall not be replaced until this is done. Restoration and repair shall be such that the damaged structure is equal to or better than its original condition and can serve its purpose as completely as before. All such restoration and repair shall be done without extra cost to the Owner.

4. Trenches must be dug to lines and grades shown on the Drawings. Hand trenching may be required in areas where machine trenching would result in undue damage to existing structures and facilities.

5. Excavation shall be open trenches, except where otherwise shown on the Drawings, for tunneling, boring, or jacking under structures, railroad, sidewalks and roads.

6. Sheeting and shoring of trenches shall be provided at the expense of the Contractor where necessary to protect life, property and the new or existing structures from damage or to maintain maximum permissible trench widths at top of pipe. All necessary materials, including, but not limited to, sheeting, sheet piling, trench jacks, braces, shores and stringers, shall be used to hold trench walls. Sheeting and shoring may be withdrawn as the trenches are being backfilled, after backfill has been tamped over top of the pipe at least 18 inches. If removal before backfill is completed to surface endangers adjacent structures, such as buildings, pipelines, street paving, and sidewalks, then the sheeting and shoring shall be left in place until such danger has passed, and then pulled if practical. Voids caused by sheeting

withdrawal shall be backfilled and tamped. If not withdrawn, sheeting shall be cut off at least 18 inches below final surface grade, so there is no obstruction at the ground level. In the event the Owner directs the Contractor to leave shoring materials in place, the Owner will reimburse the Contractor for the reasonable cost of leaving such materials in place.

7. Where subgrade of trench has insufficient stability to support the pipeline and hold it to its original grade, the Engineer may order stabilization by various means. Exclusive of dewatering normally required for construction, and instability caused by neglect of the Contractor, the necessary stabilization shall be paid for at unit prices established in the Contract. In the event no particular bid price is applicable, then the payment for stabilization will be negotiated.

8. The location of the pipelines and their appurtenances as shown are those intended for the final construction. However, conditions may present themselves before construction on any line is started that would indicate desirable changes in location. The Owner reserves the right to make reasonable changes in line and structure locations without extra cost, except as may be determined by extra units of materials and construction actually involved. The Owner is under no obligation to locate pipelines, so they may be excavated by machine.

9. Tunneling may be used at the Contractor's option as an alternate to open-cut trenching, at no extra cost to the Owner. The annular space between plates and excavation shall be either permanently placed pea gravel or sand, pumped grout (3 parts sand and 1 part Portland cement by volume) or other suitably installed material approved by the Engineer. Backfilling shall be kept close to the heading and completed after each day's work. Where grout is used for backfill, injection holes with threaded plugs shall be provided in linear plates at various levels and in sufficient number of effectively grout to void around the tunnel. A minimum of 3 grout holes shall be provided in each 8 feet of tunnel length. Grout shall be injected in the lower holes first, proceeding upward as the void is filled. Plugs shall be installed after each hole is filled and grout stops shall be provided behind plates as necessary to ensure complete filling of the void. In tunneling under buildings, the Contractor will be responsible for all damage resulting from his operations and methods of excavation and backfilling. Boring may also be used at the Contractor's option as an alternate to tunneling or open-cut trenching, at no extra cost to the Owner.

10. Dig trenches to the uniform width required for the particular item to be installed, sufficiently wide to provide ample working room. Provide 6" to 9" clearance on both sides of pipe or conduit.

a. Excavate trenches to depth indicated or required. Carry depth of trenches for piping to establish indicated flow lines and invert elevations. Beyond building perimeter, keep bottoms of trenches sufficiently below finish grade to avoid freeze-ups.

b. Where rock is encountered, carry excavation 6 inches below required elevation and backfill with a 6-inch layer of crushed stone or gravel prior to installation of pipe.

c. For pipes or conduit 3 inches or less in nominal size and for flat-bottomed, multiple-duct conduit units, excavate to subbase depth indicated or, if not indicated, then to 4 inches below bottom of work to be supported.

d. For pipes or conduit 6 inches or larger in nominal size, tanks, and other mechanical/electrical work indicated to receive subbase, excavate to subbase depth indicated or, if not otherwise indicated, to 6 inches below bottom of work to be supported.

e. Except as otherwise indicated, excavation for exterior water-bearing piping (water, steam, condensate, drainage) so top of piping is no less than 3 feet 0 inches below finish grade.

f. Grade bottoms of trenches as indicated, notching under pipe bells to provide solid bearing for entire body of pipe.

g. Backfill trenches with concrete where trench excavations pass within 18 inches of column or wall footings and which are carried below bottom of such footings, or which pass under wall footings. Place concrete to level of bottom of adjacent footing.

h. Concrete is specified in Division 3.

i. Do not backfill trenches until tests and inspections have been made and backfilling authorized by the Engineer. Use care in backfilling to avoid damage or displacement of pipe systems.

j. For piping or conduit less than 3 feet 0 inches below surface of roadways, furnish and install steel casing pipe, minimum wall thickness of 1/4", or sufficient diameter to carry the pipe or conduit to at least two feet beyond outside edge of pavement.

L. Cold Weather Protection

1. Protect excavation bottoms against freezing when atmospheric temperature is less than 35°F (1°C).

3.3 COMPACTION

A. General

1. Control soil compaction during construction providing minimum percentage of density specified for each area classification indicated below.

a. Percentage of maximum density requirements: Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture density relationship (cohesive soils) determined in accordance with ASTM D698 and not less than the following percentages of relative density, determined in accordance ASTM D4253 and D4254, for soils which will not exhibit a well-defined moisture-density relationship (cohesionless soils).

b. Structures, building slabs and steps, pavements: Compact top 12 inches of subgrade and each layer of backfill or fill material at 95 percent standard proctor density.

c. Lawn or unpaved areas: Compact top 6 inches of subgrade and each layer of backfill or fill material at 90 percent standard proctor density.

d. Walkways: Compact top 6 inches of subgrade and each layer of backfill or fill material at 95 percent standard proctor density.

B. Moisture Control

1. Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface or subgrade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations.

2. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.

3. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.

3.4 BACKFILL AND FILL

A. General

1. Place acceptable soil material in layers to required subgrade elevations, for each area classification listed below. Backfill material shall be no larger than the specified depth of the layer to be placed and/or compacted.

   a. In excavations, use satisfactory excavated or borrow material.

   b. Under grassed areas, use satisfactory excavated or borrow material.

   c. Under walks and pavements, use subbase material, or satisfactory excavated or borrow material, or combination of both.

   d. Under steps, use subbase material.

   e. Under building slabs, use subbase material for a minimum depth of 6 inches.

B. Backfill excavations as promptly as work permits, but not until completion of the following:

1. Acceptance of construction below finish grade including, where applicable, damproofing, waterproofing, and perimeter insulation.

2. Inspection, testing, approval, and recording locations of underground utilities.

3. Removal of concrete formwork.

4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.

5. Removal of trash and debris.

6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

C. Ground Surface Preparation

1. Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow,

strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.

2. When existing ground surface has a density less than that specified under "Compaction" for particular area classification, break up ground surface, pulverize, moisture condition to optimum moisture content, and compact to required depth and percentage of maximum density.

D. Placement and Compaction

1. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers. Crushed stone shall be installed in accordance with Section 02255.

a. Before compaction, add moisture or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

b. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Take care to prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.

E. Backfilling Trenches

1. Backfilling shall be accomplished as soon as practical after pipe has been laid and jointing and alignment approved. Packing of crushed rock between joints shall be the usual procedure as the laying progresses. This is in order to avoid danger of misalignment from slides, flooding or other causes. The Engineer shall be given a maximum of 24 hours for inspection before backfilling.

2. Any special requirements of the Railroad Company or Highway Department in regard to backfilling will take precedence over the following general Specifications.

3. The backfill over the pipe shall be in accordance with the standard details shown on the Drawings for bedding and backfilling pipe.

4. In case maximum permissible trench widths (as designated by the pipe manufacturer) are exceeded, the Contractor shall furnish crushed rock backfill to a minimum of 12 inches over the top of pipe at no extra cost to the Owner.

5. After the foregoing cover requirements over top of the pipe have been met, rock may be used in the backfill in pieces no larger than 12 inches in any dimension and to an extent not greater than one-half the backfilling materials used. If additional earth is required for backfilling, it must be obtained and placed by the Contractor. Filling with rock and earth shall proceed simultaneously, such that no voids are left in the rock. After cover requirements over top of pipe have been met, backfilling may be employed without tamping, provided caution is used in quantity per dump and uniformity of level of backfilling. Surplus material shall be uniformly ridged over trench and excess rock hauled away, with no rock over 1-1/2 inch diameter in the top 6 inches. Ridged backfill shall be confined to the width of the trench and no higher than needed for replacement of settlement of backfill.

6. In the case of street, highway, railroad, sidewalk and driveway crossings; or within any roadway paving; or about manholes, valve and meter boxes; the backfill must be mechanically tamped in not over 6 inch layers, measured loose. Alternate method of compacting backfill shall be used, if refill material is in large hard lumps (crushed rock excepted) which cannot be consolidated without leaving voids.

7. In the case of tunnels, the annular space between plates and excavation shall be either permanently placed pea gravel or sand, pump grout (3 parts sand and 1 part Portland cement by volume) or other suitably installed material approved by the Engineer. Backfilling shall be kept close to the heading and completed after each day's work. Where grout is used for backfill, injection holes with threaded plugs shall be provided in liner plates at various levels and in sufficient number to effectively grout the void around the tunnel. A minimum of 3 grout holes shall be provided in each 8 feet of tunnel length. Grout shall be injected in the lower holes first, proceeding upward as the void is filled. Plugs shall be installed after each hole is filled and grout stops shall be provided behind plates as necessary to ensure complete filling of the void.

8. Where traffic on streets, driveways, railroads, sidewalks and highways requires temporary surfacing, backfilling shall be terminated 4 inches below original ground level and 4 inches to 6 inches of dense graded aggregate shall be placed on the trench. Backfills shall be maintained easily passible to traffic at original ground level, until acceptance of project or replacement of paving or sidewalks.

9. The Contractor shall protect all sewer, gas, electric, telephone, water and drain pipes or conduits from damage while pipelines are being constructed and backfilled, and from danger due to settlement of trench backfill.

10. No extra pavement shall be made for backfilling of any kind, except as specified hereinbefore. Backfilling shall be included as a part of the lump sum bid. No extra payment will be made to the Contractor for supplying outside materials for backfill.

11. On completion of the project, all backfills shall be dressed; holes filled; and surplus material hauled away. All permanent walks, street paving, roadway, etc., shall be restored and seeding and sodding performed as required.

3.5 GRADING

A. General

1. Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades.

B. Grading Outside Building Lines

1. All materials used for backfill around structures shall be of a quality acceptable to the Engineer and shall be free from large or frozen lumps, wood and other extraneous material. All spaces excavated and not occupied by footings, foundations walls or other permanent work shall be refilled with earth up to the surface of the surrounding ground, unless otherwise specified, with sufficient allowance for settlement. In making the fills and terraces around the structures, the fill shall be placed in layers not exceeding 12 inches in depth and shall be kept smooth as the work progresses. Each layer of the fill shall be rolled with an approved type roller and/or be compacted. When it is not practicable to compact sections of the fill immediately adjacent to buildings or structures by rolling, then such section shall be thoroughly compacted by means of mechanical tamping or hand tamping as may be required by the conditions encountered. All fills shall be placed so as to load structures symmetrically.

2. As set out hereinbefore, rough grading shall be held below finished grade and then the topsoil which has been stockpiled shall be evenly spread over the surface. The grading shall be brought to the levels shown on the

Drawings or to the elevations established by the Engineer. Final dressing shall be accomplished by hand work or machine work, or a combination of these methods as may be necessary to produce a uniform and smooth finish to all parts of the regrade. The surface shall be free from clods greater than 2 inches in diameter. Excavated rock may be placed in the fills, but it shall be thoroughly covered. Rock placed in fills shall not be closer than 12 inches from finished grade.

3. Grade areas adjacent to building lines to drain away from structures and to prevent ponding.

   a. Finish surfaces free from irregular surface changes, and as follows:

      (1) Lawn or unpaved areas: Finish areas to receive topsoil to within not more than 0.10 ft. above or below required subgrade elevations.

      (2) Walks: Shape surface of areas under walks to line, grade, and cross-section, with finish surface not more than 0.0 inch above or 1.0 inch below required subgrade elevation.

      (3) Pavements: Shape surface of areas under pavement to line, grade, and cross-section, with finish surface not more than 0.0 inch above or 1 inch below required subgrade elevation.

C. Grading Surface of Fill Under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 0.0 inch above or 1 inch below required subgrade elevation when tested with a 10 ft. straightedge.

D. Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or standard proctor density for each area classification.

3.6 PAVEMENT SUBBASE COURSE

A. General

1. Subbase course consists of placing subbase material, in layers of specified thickness, over subgrade surface to support a pavement base course.

2. See other Division 2 sections for paving specifications.

B. Grade Control: During construction, maintain lines and grades including crown and cross-slope of subbase course.

C. Shoulders

1. Place shoulders along edges of subbase course to prevent lateral movement. Construct shoulders of acceptable soil materials, placed in such quantity to compact to thickness of each subbase course layer. Compact and roll at least a 12 inch width of shoulder simultaneously with compacting and rolling of each layer of subbase course.

D. Placing

1. Place subbase course material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting subbase material during placement operations.

2. When a compacted subbase course is shown to be 6 inches thick or less, place material in a single layer. When shown to be more than 6 inches thick, place material in equal layers, except no single layer more than 6 inches or less than 3 inches in thickness when compacted.

3.7 BUILDING SLAB ENGINEERED FILL COURSE

A. General

1. Engineered fill course consists of placement of crushed stone, size and type shown on drawings, in layers of indicated thickness, over subgrade surface to support concrete building slabs.

B. Placing

1. Place fill material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting material during placement operations.

2. When a compacted course is shown to be 6 inches or less, place material in a single layer. When shown to be more than 6 inches thick, place material in equal layers, except no single layer shall be more than 6 inches or less than 3 inches in thickness when compacted.

3.8 FIELD QUALITY CONTROL

A. Quality Control Testing During Construction

1. Allow testing service to inspect and report to the Engineer on findings and approve subgrades and fill layers before further construction work is performed.

   a. Perform field density tests in accordance with ASTM D 1556 (sand cone method), ASTM D 2167 (rubber balloon method), or ASTM D 2992 (nuclear density method), as applicable.

   b. Footing subgrade: For each strata of soil on which footings will be placed, conduct at least one test to verify required design bearing capacities. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested strata, when acceptable to Engineer.

   c. Paved areas and building slab subgrade: Make at least one field density test of subgrade for every 2,000 square feet of paved area or building slab, but in no case less than three tests. In each compacted fill layer, make one field density test for every 2,000 square feet of overlaying building slab or paved area, but in no case less than three tests.

   d. Foundation wall backfill: Take at least two field density tests, at locations and elevations as directed.

B. If in opinion of the Engineer, based on testing service reports and inspection, subgrade or fills which have been placed are below specified density, provide additional compaction and testing at no additional expense.

3.9 MAINTENANCE

A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

B. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

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

END OF SECTION

SECTION 02255
Crushed Stone and Dense Graded Aggregate

PART 1 GENERAL

1.1 SCOPE

A. Furnish and install crushed stone for miscellaneous uses as shown on the Drawings, as called for in the Specifications.

B. Sizes, types, and quality of crushed stone are specified in this Section, but its use for replacement of unsuitable material, pavement base, and similar uses is specified in detail elsewhere in the Specifications. The Engineer may order the use of crushed stone for purposes other than those specified in other sections, if, in his opinion, such use is advisable. Payment for same will be subject to negotiation.

PART 2 PRODUCTS

2.1 MATERIALS

A. When referred to in these Specifications, crushed stone shall be Number 57 graded in accordance with the Kentucky Transportation Cabinet, Department of Highways, Standard Specifications for Road and Bridge Construction, Latest Edition, unless otherwise noted.

B. When referred to in these Specifications, dense graded aggregate (DGA) shall be crushed stone classified by the Kentucky Transportation Cabinet, Department of Highways, Standard Specifications for Road and Bridge Construction, Latest Edition, and conforming to the following requirements:

Sieve Size	Percent Passing
1 inch	100
3/4 inch	70-100
3/8 inch	50-80
#4	35-65
#10	25-50
#40	15-30
#200	5-12

PART 3 EXECUTION

3.1 INSTALLATION

A. Crushed stone shall be placed in uniform layers not greater than 6 inches deep and shaped by power equipment to required lines, grades, cross sections, and depths. No minimum compacted density, method of compaction, or compaction equipment is required since a nominal amount of compaction effort with vibration can establish the desired intergranular locking of the aggregate under controlled placement depth. Acceptable compaction can be achieved with pneumatic-tired and tracked equipment and rollers.

B. All compaction operation shall be performed to the satisfaction of the Engineer.

C. Crushed stone shall be placed in those areas as shown on the Drawings and as may be directed by the Engineer.

END OF SECTION

SECTION 02665
Water Mains and Accessories

PART 1 GENERAL

1.01 SCOPE

A. This Section describes products to be incorporated into the water mains and requirements for the installation and use of these items. Furnish all products and perform all labor necessary to fulfill the requirements of these Specifications.

B. General: Supply all products and perform all work in accordance with applicable American Society for Testing and Material (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI), or other recognized standards. Latest revisions of all standards are applicable.

1.02 QUALIFICATIONS

If requested by the Engineer, submit evidence that manufacturers have consistently produced products of satisfactory quality and performance for a period of at least two years.

1.03 SUBMITTALS

Complete shop drawings and engineering data for all products shall be submitted to the Engineer in accordance with the requirements of Section 01340 of these Specifications.

1.04 TRANSPORTATION AND HANDLING

A. Unloading: Furnish equipment and facilities for unloading, handling, distributing and storing pipe, fittings, valves and accessories. Make equipment available at all times for use in unloading. Do not drop or dump materials. Any materials dropped or dumped will be subject to rejection without additional justification. Pipe handled on skids shall not be rolled or skidded against the pipe on the ground.

B. Handling: Handle pipe, fittings, valves and accessories carefully to prevent shock or damage. Handle pipe by rolling on skids, forklift, or front end loader. Do not use material damaged in handling. Slings, hooks or pipe tongs shall be padded and used in such a manner as to prevent damage to the exterior coatings or internal lining of the pipe.

1.05 OWNER FURNISHED MATERIALS (Not Used)

1.06 STORAGE AND PROTECTION

A. Store all pipe which cannot be distributed along the route. Contractor shall make arrangements for the use of suitable storage areas.

B. Stored materials shall be kept safe from damage. The interior of all pipe, fittings and other appurtenances shall be kept free from dirt or foreign matter at all times. Valves and hydrants shall be drained and stored in a manner that will protect them from damage by freezing.

C. Pipe shall not be stacked higher than the limits recommended by the manufacturer. The bottom tier shall be kept off the ground on timbers, rails or concrete. Pipe in tiers shall be alternated: bell, plain end; bell, plain end. At least two rows of timbers shall be placed between tiers and chocks, affixed to each other in order to prevent movement. The timbers shall be large enough to prevent contact between the pipe in adjacent tiers.

D. Stored mechanical and push-on joint gaskets shall be placed in a cool location out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-in, first-out basis.

E. Mechanical-joint bolts shall be handled and stored in such a manner that will ensure proper use with respect to types and sizes.

1.07 QUALITY ASSURANCE

The manufacturer shall provide written certification to the Engineer that all products furnished comply with all applicable requirements of these Specifications.

PART 2 PRODUCTS

2.01 PIPING MATERIALS AND ACCESSORIES

A. Ductile Iron Pipe (DIP)

1. Ductile iron pipe shall be manufactured in accordance with AWWA C151. All pipe, except specials, shall be furnished in nominal lengths of 18 to 20 feet. Sizes will be as shown on the Drawings. All pipe shall have a minimum pressure rating as indicated in the following table, and corresponding minimum wall thickness, unless otherwise specified or shown on the Drawings:

Pipe Sizes (inches)	Pressure Class (psi)
4 - 12	350
14 - 18	250
20	250
24	200
30 - 54	250
60 - 64	200

2. Flanged pipe minimum wall thickness shall be equal to Special Class 53. Flanges shall be furnished by the pipe manufacturer.

3. Pipe and fittings shall be cement lined in accordance with AWWA C104. Pipe and fittings shall be furnished with a bituminous outside coating.

4. Fittings shall be ductile iron and shall conform to AWWA C110 or AWWA C153 with a minimum rated working pressure of 250 psi or as indicated on plans.

5. Joints

   a. Unless shown or specified otherwise, joints shall be push-on or restrained joint type for pipe and standard mechanical, push-on or restrained joints for fittings. Push-on and mechanical joints shall conform to AWWA C111. Restrained joints for pipe and fittings shall be American "FLEX-RING" or "LOK-RING", Clow "SUPER-LOCK", or U.S. Pipe "TR FLEX". No field welding of restrained joint pipe will be permitted. No mega lug type restraints are allowed on 24" and 30" water line.
   b. Restrained joint pipe (RJP) on supports shall have bolted joints and shall be specifically designed for clear spans of at least 36 feet.
   c. Flanged joints shall meet the requirements of ANSI B16.1, Class 125.

6. Provide the appropriate gaskets for mechanical and flange joints. Gaskets for flange joints shall be made of 1/8-inch thick, cloth reinforced rubber; gaskets may be ring type or full face type.

7. Provide the necessary bolts for mechanical, restrained and flange connections. Bolts for flange connections shall be steel with American

Regular unfinished square or hexagon heads. Nuts shall be steel with American Standard Regular hexagonal dimensions, all as specified in ANSI B17.2. All bolts and all nuts shall be threaded in accordance with ANSI B1.1, Coarse Thread Series, Class 2A and 2B fit. Mechanical joint glands shall be ductile iron.

8. Acceptance will be on the basis of the Engineer's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards.

B. Polyvinyl Chloride Pipe (PVC) - **(SDR-21)**

1. All PVC pipe shall have belled ends for push-on type jointing and shall conform to ASTM D 2241. The pipe shall have a Standard Dimension Ratio (SDR) of 21 and shall be capable of withstanding a working pressure of 200 psi. Pipe shall be supplied in minimum lengths of 20 feet.

2. All fittings shall be of cast or ductile iron meeting the requirements of AWWA C110 or AWWA C153 with a minimum rated working pressure of 150 psi. Fittings shall be cement lined in accordance with AWWA C104. Fittings shall be furnished with a bituminous outside coating. Special adapters shall be provided as recommended by the manufacturer to adapt the PVC pipe to mechanical jointing with cast or ductile iron pipe, fittings, or valves.

3. Detection tape shall be provided over all PVC water mains.

4. Acceptance will be on the basis of the Engineer's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards, including the National Sanitation Foundation. Additionally, each piece of pipe shall be stamped "NSF Approved".

C. Polyvinyl Chloride Pipe (PVC) - **(C-900)**

1. All PVC pipe shall have belled ends for push-on type jointing and shall conform to AWWA C900, ductile iron pipe equivalent outside diameters. The pipe shall have a Dimension Ratio (DR) of **14** and shall be capable of withstanding a working pressure of **200** psi. Pipe shall be supplied in minimum lengths of 20 feet.

2. All fittings shall be of cast or ductile iron meeting the requirements of AWWA C110 or AWWA C153 with a minimum rated working pressure of

250 psi. Fittings shall be cement lined in accordance with AWWA C104. Fittings shall be furnished with a bituminous outside coating. Special adapters shall be provided, as recommended by the manufacturer, to adapt the PVC pipe to mechanical jointing with cast or ductile iron pipe, fittings or valves.

3. Detection tape shall be provided over all PVC water mains.

4. Acceptance will be on the basis of the Engineer's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards, including the National Sanitation Foundation. Additionally, each piece of pipe shall be stamped "NSF Approved".

2.02 VALVES

A. Gate Valves (GV)

1. 3-Inches in Diameter and Smaller: Gate valves shall be bronze, heavy duty, rising stem, wedge type with screwed or union bonnet. Valve ends shall be threaded or solder type as appropriate. Valves shall have a minimum 200 psi working pressure for water (125 psi working pressure for steam). Valves shall be made in the U.S.A. Gate valves shall be equal to Crane No. 428 (threaded) or Crane No. 1334 (solder end).

2. 4-Inches Through 12-Inches in Diameter: Gate valves 4-inches through 12-inches shall be resilient wedge type conforming to the requirements of AWWA C509 rated for 200 psi working pressure.

   a. Valves shall be provided with two O-ring stem seals with one O-ring located above and one O-ring below the stem collar. The area between the O-rings shall be filled with lubricant to provide lubrication to the thrust collar bearing surfaces each time the valve is operated. At least one anti-friction washer shall be utilized to further minimize operating torque. All seals between valve parts, such as body and bonnet, bonnet and bonnet cover, shall be flat gaskets or O-rings.
   b. The valve gate shall be made of cast iron having a vulcanized, synthetic rubber coating, or a seat ring attached to the disc with retaining screws. Sliding of the rubber on the seating surfaces to compress the rubber will not be allowed. The design shall be such that compression-set of the rubber shall not affect the ability of the

valve to seal when pressure is applied to either side of the gate. The sealing mechanism shall provide zero leakage at the water working pressure when installed with the line flow in either direction.

c. All internal ferrous surfaces shall be coated with epoxy to a minimum thickness of 4 mils. The epoxy shall be non-toxic, impart no taste to the water and shall conform to AWWA C550, latest revision.

d. Gate valves 4 through 12-inches shall be manufactured by American-Darling, Mueller or M & H Valve.

B. Butterfly Valves (BV)

1. Butterfly valves shall be resilient seated, short body design, and shall be designed, manufactured, and tested in accordance with all requirements of AWWA C504, and as modified below. Valves shall be designed for a rated working pressure of 250 psi. Class B, AWWA C504 Section 5.2 testing requirements are modified as follows:

   a. the leakage test shall be performed at a pressure of 250 psi;
   b. the hydrostatic test shall be performed at a pressure of 500 psi; and
   c. proof of design tests shall be performed and certification of such proof of design test shall be provided to the Engineer.

2. Valve bodies shall be ductile iron conforming to ASTM A 536, Grade 65-45-12 or ASTM A 126, Grade B cast iron. Shafts and shaft hardware shall be ASTM A 564, Type 630 stainless steel, machined and polished. Valve discs shall be ductile iron, ASTM A 536, Grade 65-45-12. The resilient valve seat shall be located either on the valve disc or in the valve body and shall be fully field adjustable and field replaceable.

3. Valves shall be installed with the valve shafts horizontal. Valves and actuators shall have seals on all shafts and gaskets on valve actuator covers to prevent the entry of water. Actuator mounting brackets shall be totally enclosed and shall have gasket seals.

4. Actuators

   a. Valves shall be equipped with traveling nut, self-locking type actuators designed, manufactured and tested in accordance with AWWA C504. Actuators shall be capable of holding the disc in any position between full open and full closed without any movement or fluttering of the disc.

b. Actuators shall be furnished with fully adjustable mechanical stop-limiting devices. Actuators that utilize the sides of the actuator housing to limit disc travel are unacceptable.

c. Valve actuators shall be capable of withstanding a minimum of 450 foot pounds of input torque in either the open or closed position without damage.

5. Operators: Valves for buried service shall have a nut type operator and shall be equipped with a valve box and stem extension, as required.

6. Valve ends shall be mechanical joint type, except where flanged or restrained joint ends are shown. Flange joints shall meet the requirements of ANSI B16.1, Class 125. MJ Joint ends shall be restrained were called for using American MJ coupled joint or approved equal.

7. Butterfly valves shall be manufactured by Mueller, M & H Valve, DeZurik, or Pratt.

2.03 FIRE HYDRANTS (FH)

A. All fire hydrants shall conform to the requirements of AWWA C502 for 250 psi working pressure. Hydrants shall be the compression type, closing with line pressure. The valve opening shall not be less than [5-1/4-inches].

B. In the event of a traffic accident, the hydrant barrel shall break away from the standpipe at a point above grade and in a manner which will prevent damage to the barrel and stem, preclude opening of the valve, and permit rapid and inexpensive restoration without digging or cutting off the water.

C. The means for attaching the barrel to the standpipe shall permit facing the hydrant a minimum of eight different directions.

D. Hydrants shall be fully bronze mounted with all working parts of bronze. Valve seat ring shall be bronze and shall screw into a bronze retainer.

E. All working parts, including the seat ring shall be removable through the top without disturbing the barrel of the hydrant.

F. The operating nut shall match those on the existing hydrants. The operating threads shall be totally enclosed in an operating chamber, separated from the hydrant barrel by a rubber O-ring stem seal and lubricated by a grease or an oil reservoir.

G. Hydrant shall be a non-freezing design and be provided with a simple, positive, and automatic drain which shall be fully closed whenever the main valve is opened.

H. Hose and pumper connections shall be breech-locked, pinned, or threaded and pinned to seal them into the hydrant barrel. Each hydrant shall have two 2-1/2-inch hose connections and one 4-1/2-inch pumper connection, all with National Standard threads and each equipped with cap and non-kinking chain.

I. Hydrants shall be furnished with a mechanical joint connection to the spigot of the 6-inch hydrant lead.

J. Minimum depth of bury shall be 4.5 feet. Provide extension section where necessary for proper vertical installation and in accordance with manufacturer's recommendations.

K. All outside surfaces of the barrel above grade shall be painted with enamel equal to Koppers Glamortex 501 in a color to be selected by the Owner.

L. Hydrants shall be traffic model and shall be Mueller Super Centurion or approved equal.

2.04 VALVE BOXES (VB) AND EXTENSION STEMS

A. All valves shall be equipped with valve boxes. The valve boxes shall be cast iron two-piece screw type with drop covers. Valve boxes shall have a 5.25-inch inside diameter. Valve box covers shall weigh a minimum of 13 pounds. The valve boxes shall be adjustable to 6-inches up or down from the nominal required cover over the pipe. Valve boxes shall be of sufficient length that bottom flange of the lower belled portion of the box is below the valve operating nut. Ductile or cast iron extensions shall be provided as necessary. Covers shall have "WATER VALVE" or "WATER" cast into them. Valve boxes shall be manufactured in the United States.

B. All valves shall be furnished with extension stems, as necessary, to bring the operating nut to within 30-inches of the top of the valve box. Connection to the valve shall be with a wrench nut coupling and a set screw to secure the coupling to the valve's operating nut. The coupling and square wrench nut shall be welded to the extension stem. Extension stems shall be equal to Mueller A-26441 or M & H Valve Style 3801.

2.05 VALVE MARKERS (VM)

The Contractor shall provide a concrete valve marker as detailed on the Drawings for each valve installed. Valve markers shall be stamped "Water".

2.06 TAPPING SLEEVES AND VALVES (TS&V)

Tapping sleeves shall be cast or ductile iron of the split-sleeve, mechanical joint type. The Contractor shall be responsible for determining the outside diameter of the pipe to be connected to prior to ordering the sleeve. Valves shall be gate valves furnished in accordance with the specifications shown above, with flanged connection to the tapping sleeve and mechanical joint connection to the branch pipe. The tapping sleeve and valve shall be supplied by the valve manufacturer. Tapping sleeves shall be equal to American-Darling, Mueller or M & H Valve.

2.07 TAPPING SADDLES

Tapping saddles shall be ductile iron body type with O-ring gasket and alloy steel straps. Connection shall be flanged or mechanical joint as detailed on the Drawings. Tapping saddles shall be equal to **ACIPCO A-10920**.

2.08 CORPORATION COCKS AND CURB STOPS

Corporation cocks and curb stops shall be ground key type, shall be made of bronze conforming to ASTM B 61 or B 62, and shall be suitable for the working pressure of the system. Ends shall be suitable for flared tube compression type joint. Threaded ends for inlet and outlet of corporation cocks shall conform to AWWA C800; coupling nut for connection to flared copper tubing shall conform to ANSI B16.26. Corporation cocks and curb stops shall be manufactured by Mueller or Ford.

2.09 AIR VALVES

A. Air Release Valves: Air release valves shall be one of the following types:

1. The air release valve shall automatically release air accumulations from the pipeline due to the action of the float. When the air valve body fills with air, the float falls freely from the orifice to allow the air to escape to the atmosphere. When all the air has been exhausted from the valve body, the float will be buoyed up to seat against the orifice and prevent water from

being exhausted from the valve. The valve body and cover shall be constructed of cast iron (ASTM A 126-B). A synthetic orifice button shall be affixed to the valve cover to provide a non-corrosive seat for the float. The float shall be constructed of stainless steel. A resilient, Buna-N seat shall be attached to the float for drop-tight closure. The float shall be free floating within the valve body. Valve orifice size shall be as shown on the Drawings.

2. The air release valve shall automatically release air accumulations from the pipeline due to the action of the float and lever mechanism. When the air valve body fills with air, the float falls. Through the leverage mechanism, this causes the resilient seat to open the orifice and allow the air to escape to the atmosphere. When all the air has been exhausted from the valve body, the float will be buoyed up. Through the leverage mechanism, this will cause the resilient seat to close the orifice, preventing water from being exhausted from the valve. The valve body and cover shall be constructed of cast iron (ASTM A 126-B). The float shall be constructed of stainless steel and attached to a stainless steel lever mechanism. A resilient, Buna-N seat shall be attached to the lever mechanism for drop-tight closure. Valve orifice size shall be as shown on the Drawings.

B. Air/Vacuum Valve: The air/vacuum valve shall discharge large amounts of air as the pipeline fills and allow air to enter the pipeline as it drains or in the event of vacuum conditions. The valve shall operate by means of a non-collapsible stainless steel float which seals an orifice. As air enters the valve the float shall drop from the orifice and allow the air to escape. As water rises in the valve, the float will again seal the orifice. The valve will be of such design that the float cannot blow shut at any air velocity. All working parts shall be of stainless steel. The inside of the valve body shall be epoxy coated. Valve inlet size shall be as shown on the Drawings.

C. Combination Air Valves: Combination air valves shall combine the features of an air release valve and an air/vacuum valve and shall be of one of the following types:

1. Valve shall consist of an air/vacuum valve described in paragraph B. above, with an air release valve described in A. above tapped into its body. The valve shall be of two-piece body design with an isolation gate valve separating the two valves.

2. Valve shall be single body, double orifice, allowing large volumes of air to escape out the larger diameter air and vacuum orifice when filling a pipeline and closes watertight when the liquid enters the valve. During large orifice

closure, the smaller diameter air release orifice will open to allow small pockets of air to escape automatically and independently of the large orifice. The large air/vacuum orifice shall also allow large volumes of air to enter through the orifice during pipeline drainage to break the vacuum. The Buna-N seats must be fastened to the valve, without distortion, for drop-tight shut-off. The float shall be stainless steel. Valve sizes shall be as shown on the Drawings.

D. Surge Check Valve: Where shown on the Drawings or specified, provide a surge check valve on the inlet of the air/vacuum valve. The surge check valve shall be normally open, spring loaded valve consisting of a body, seat and plug bolted to the inlet of the air/vacuum valve. The surge check shall operate on the interphase between the kinetic energy and relative velocity flows of air and water, allowing air to pass through but water shall close the surge check, reducing the rate of water flow by means of throttling orifices in the plug to prevent shock closure of the air/vacuum valve. The surge check orifices must be an adjustable type to suit operating conditions in the field.

E. All air valves and accessories shall be supplied by a single manufacturer and shall be G.A. Industries, APCO, Crispin or Val-Matic.

2.10 METER SETTERS

The meter setter shall be a tandem coppersetter as shown on the standard detail drawings with 3/4" double purpose ends and be 15" high with padlock wing. It shall be all purpose, designed for 5/8" x 3/4" meter and be of sufficient height to raise meters above the bottom of the meter box. The meter setter shall be Ford, or equal. Meter setters shall have an inverted key inlet valve.

Setters shall be installed so that the meters are centered in the meter box.

The water service line shall be extended a minimum of 18" beyond the meter box on the customer end. The end of the extension shall be capped or plugged to prevent entry of foreign material until the connection is made.

2.11 WATER METERS

Water meter shall be cold water displacement type meeting all requirement of AWWA C700-77. The meter sizes shall be 5/8-inch x 3/4-inch meters for 3/4" service rated at a flow of 20 gpm and 1" meters for 1" service rated at a flow of 50 gpm. Meters shall be of frost-proof design and be rotating disk type. The meters shall be equipped with a straight-reading register recording in U.S. Gallons hermetially sealed to prevent fogging and with a removable corrosion resistant

strainer screen between the outer case and measuring chamber. Register shall be equipped with a device to afford capability for accurately testing each meter according to AWWA Standards. The body case shall have the manufacturer's serial number imprinted thereon and have raised markings to indicate the direction of flow.

2.12 HYDRANT TEES (Not Used)

2.13 ANCHOR COUPLINGS (Not Used)

2.14 VALVE KEYS

The Contractor shall provide to the Owner one valve key for every five valves provided, but no more than three and not less than one valve key. Valve keys shall be 72-inches long with a tee handle and a 2-inch square wrench nut. Valve keys shall be furnished by the valve manufacturer. Valve keys shall be equal to Mueller A-24610 or ACIPCO No. 1303.

2.15 CONCRETE

Concrete shall have a compressive strength of not less than 3000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5-inches. For job mixed concrete, submit the concrete mix design for approval by the Engineer. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94. Reinforcing steel shall conform to the requirements of ASTM A 615, Grade 60.

PART 3 EXECUTION

3.01 EXISTING UTILITIES AND OBSTRUCTIONS

A. The Drawings indicate utilities or obstructions that are known to exist according to the best information available to the Owner. The Contractor shall call the agencies or departments that own and/or operate utilities in the vicinity of the construction work site at least 72 hours (three business days) prior to construction to verify the location of the existing utilities.

B. Existing Utility Location: The following steps shall be exercised to avoid interruption of existing utility service.

1. Provide the required notice to the utility owners and allow them to locate their facilities. Field utility locations are valid for only 10 days after original notice. The Contractor shall ensure, at the time of any excavation, that a valid utility location exists at the point of excavation.

2. Expose the facility, for a distance of at least 200 feet in advance of pipeline construction, to verify its true location and grade. Repair, or have repaired, any damage to utilities resulting from locating or exposing their true location.

3. Avoid utility damage and interruption by protection with means or methods recommended by the utility owner.

4. Maintain a log identifying when phone calls were made, who was called, area for which utility relocation was requested and work order number issued, if any. The Contractor shall provide the Engineer an updated copy of the log bi-weekly, or more frequently if required.

C. Conflict with Existing Utilities

1. Horizontal Conflict: Horizontal conflict shall be defined as when the actual horizontal separation between a utility, main, or service and the proposed water main does not permit safe installation of the water main by the use of sheeting, shoring, tieing-back, supporting, or temporarily suspending service of the parallel or crossing facility. The Contractor may change the proposed alignment of the water main to avoid horizontal conflicts if the new alignment remains within the available right-of-way or easement, complies with regulatory agency requirements and after a written request to and subsequent approval by the Engineer. Where such relocation of the water main is denied by the Engineer, the Contractor shall arrange to have the utility, main, or service relocated.

2. Vertical Conflict: Vertical conflict shall be defined as when the actual vertical separation between a utility, main, or service and the proposed water main does not permit the crossing without immediate or potential future damage to the utility, main, service, or the water main. The Contractor may change the proposed grade of the water main to avoid vertical conflicts if the changed grade maintains adequate cover and complies with regulatory agencies requirements after written request to and subsequent approval by the Engineer. Where such relocation of the water main is denied by the Engineer, the Contractor shall arrange to have the utility, main, or service relocated.

D. Electronic Locator: Have available at all times an electronic pipe locator and a magnetic locator, in good working order, to aid in locating existing pipe lines or other obstructions.

E. Water and Sewer Separation

1. Water mains should maintain a minimum 10 foot edge-to-edge separation from sewer lines, whether gravity or pressure. If the main cannot be installed in the prescribed easement or right-of-way and provide the 10 foot separation, the separation may be reduced, provided the bottom of the water main is a minimum of 18-inches above the top of the sewer. Should neither of these two separation criteria be possible, the water main shall be installed below the sewer with a minimum vertical separation of 18-inches.

2. The water main, when installed below the sewer, shall be encased in concrete with a minimum 6-inch concrete depth to the first joint in each direction. Where water mains cross the sewer, the pipe joint adjacent to the pipe crossing the sewer shall be cut to provide maximum separation of the pipe joints from the sewer.

3. No water main shall pass through, or come in contact with, any part of a sanitary sewer manhole.

3.02 CONSTRUCTION ALONG HIGHWAYS, STREETS AND ROADWAYS

A. Install pipe lines and appurtenances along highways, streets and roadways in accordance with the applicable regulations of, and permits issued by, the Department of Transportation, Mason and Fleming Counties and the City of Flemingsburg with reference to construction operations, safety, traffic control, road maintenance and repair.

B. Traffic Control

1. The Contractor shall provide, erect and maintain all necessary barricades, suitable and sufficient lights and other traffic control devices; provide qualified flagmen where necessary to direct traffic; take all necessary precautions for the protection of the work and the safety of the public.

2. Construction traffic control devices and their installation shall be in accordance with the current Manual On Uniform Traffic Control Devices for Streets and Highways.

3. Placement and removal of construction traffic control devices shall be coordinated with the Department of Transportation, Mason and Fleming Counties and the City of Flemingsburg a minimum of 48 hours in advance of the activity.

4. Placement of construction traffic control devices shall be scheduled ahead of associated construction activities. Construction time in street

right-of-way shall be conducted to minimize the length of time traffic is disrupted. Construction traffic control devices shall be removed immediately following their useful purpose. Traffic control devices used intermittently, such as "Flagmen Ahead", shall be removed and replaced when needed.

5. Existing traffic control devices within the construction work zone shall be protected from damage. Traffic control devices requiring temporary relocation shall be located as near as possible to their original vertical and horizontal locations. Original locations shall be measured from reference points and recorded in a log prior to relocation. Temporary locations shall provide the same visibility to affected traffic as the original location. Relocated traffic control devices shall be reinstalled in their original locations as soon as practical following construction.

6. Construction traffic control devices shall be maintained in good repair and shall be clean and visible to affected traffic for daytime and nighttime operation. Traffic control devices affected by the construction work zone shall be inspected daily.

7. Construction warning signs shall be black legend on an orange background. Regulatory signs shall be black legend on a white background. Construction sign panels shall meet the minimum reflective requirements of the Department of Transportation, Mason and Fleming Counties and the City of Flemingsburg. Sign panels shall be of durable materials capable of maintaining their color, reflective character and legibility during the period of construction.

8. Channelization devices shall be positioned preceding an obstruction at a taper length as required by the current Manual On Uniform Traffic Control Devices for Streets and Highways, as appropriate for the speed limit at that location. Channelization devices shall be patrolled to insure that they are maintained in the proper position throughout their period of use.

C. Construction Operations

1. Perform all work along highways, streets and roadways to minimize interference with traffic.

2. Stripping: Where the pipe line is laid along road right-of-way, strip and stockpile all sod, topsoil and other material suitable for right-of-way restoration.

3. Trenching, Laying and Backfilling: Do not open the trench any further ahead of pipe laying operations than is necessary. Backfill and remove excess material immediately behind laying operations. Complete excavation and backfill for any portion of the trench in the same day.

4. Shaping: Reshape damaged slopes, side ditches, and ditch lines immediately after completing backfilling operations. Replace topsoil, sod and any other materials removed from shoulders.

5. Construction operations shall be limited to 400 feet along areas within KYDOT jurisdiction, including clean-up and utility exploration.

D. Excavated Materials: Do not place excavated material along highways, streets and roadways in a manner which obstructs traffic. Sweep all scattered excavated material off of the pavement in a timely manner.

E. Drainage Structures: Keep all side ditches, culverts, cross drains, and other drainage structures clear of excavated material. Care shall be taken to provide positive drainage to avoid ponding or concentration of runoff.

F. Landscaping Features: Landscaping features shall include, but are not necessarily limited to: fences; property corners; cultivated trees and shrubbery; manmade improvements; subdivision and other signs within the right-of-way and easement. The Contractor shall take extreme care in moving landscape features and promptly re-establishing these features.

G. Maintaining Highways, Streets, Roadways and Driveways

1. Maintain streets, highways, roadways and driveways in suitable condition for movement of traffic until completion and final acceptance of the Work.

2. During the time period between pavement removal and completing permanent pavement replacement, maintain highways, streets and roadways by the use of steel running plates. Running plate edges shall have asphalt placed around their periphery to minimize vehicular impact. The backfill above the pipe shall be compacted as specified elsewhere up to the existing pavement surface to provide support for the steel running plates.

3. Furnish a road grader or front-end loader for maintaining highways, streets, and roadways. The grader or front-end loader shall be available at all times.

4. Immediately repair all driveways that are cut or damaged. Maintain them in a suitable condition for use until completion and final acceptance of the Work.

3.03 PIPE DISTRIBUTION

A. Pipe shall be distributed and placed in such a manner that will not interfere with traffic.

B. No pipe shall be strung further along the route than 1000 feet beyond the area in which the Contractor is actually working without written permission from the Owner.

C. No street or roadway may be closed for unloading of pipe without first obtaining permission from the proper authorities. The Contractor shall furnish and maintain proper warning signs and obstruction lights for the protection of traffic along highways, streets and roadways upon which pipe is distributed.

D. No distributed pipe shall be placed inside drainage ditches.

E. Distributed pipe shall be placed as far as possible from the roadway pavement, but no closer than five feet from the roadway pavement, as measured edge-to-edge.

3.04 LOCATION AND GRADE

A. The Drawings show the alignment of the water main and the location of valves, hydrants and other appurtenances.

B. Construction Staking

1. The base lines for locating the principal components of the work and a bench mark adjacent to the work are shown on the Drawings. Base lines shall be defined as the line to which the location of the water main is referenced, i.e., edge of pavement, road centerline, property line, right-of-way or survey line. The Contractor shall be responsible for performing all survey work required for constructing the water main, including the establishment of base lines and any detail surveys needed for construction. This work shall include the staking out of permanent and temporary easements to insure that the Contractor is not deviating from the designated easements.

2. The level of detail of survey required shall be that which the correct location of the water main can be established for construction and verified by the

Engineer. Where the location of components of the water main, e.g. tunnels and fittings, are not dimensioned, the establishment on the location of these components shall be based upon scaling these locations from the Drawings with relation to readily identifiable land marks, e.g., survey reference points, power poles, manholes, etc.

C. Reference Points

1. The Contractor shall take all precautions necessary, which includes, but is not necessarily limited to, installing reference points, in order to protect and preserve the centerline or baseline established by the Engineer.

2. Reference points shall be placed, at or no more than three feet, from the outside of the construction easement or right-of-way. The location of the reference points shall be recorded in a log with a copy provided to the Engineer for use, prior to verifying reference point locations. Distances between reference points and the manhole centerlines shall be accurately measured to 0.01 foot.

3. The Contractor shall give the Engineer reasonable notice that reference points are set. The reference point locations must be verified by the Engineer prior to commencing clearing and grubbing operations.

D. After the Contractor locates and marks the water main centerline or baseline, the Contractor shall perform clearing and grubbing.

E. Construction shall begin at a connection location and proceed without interruption. Multiple construction sites shall not be permitted without written authorization from the Engineer for each site.

F. The Contractor shall be responsible for any damage done to reference points, base lines, center lines and temporary bench marks, and shall be responsible for the cost of re-establishment of reference points, base lines, center lines and temporary bench marks as a result of the operations.

3.05 LAYING AND JOINTING PIPE AND ACCESSORIES

A. Lay all pipe and fittings to accurately conform to the lines and grades established by the Engineer.

B. Pipe Installation

1. Proper implements, tools and facilities shall be provided for the safe performance of the Work. All pipe, fittings, valves and hydrants shall be lowered carefully into the trench by means of slings, ropes or other suitable tools or equipment in such a manner as to prevent damage to water main materials and protective coatings and linings. Under no circumstances shall water main materials be dropped or dumped into the trench.

2. All pipe, fittings, valves, hydrants and other appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective materials shall be marked and held for inspection by the Engineer, who may prescribe corrective repairs or reject the materials.

3. All lumps, blisters and excess coating shall be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped clean and dry and free from dirt, sand, grit or any foreign materials before the pipe is laid. No pipe containing dirt shall be laid.

4. Foreign material shall be prevented from entering the pipe while it is being placed in the trench. No debris, tools, clothing or other materials shall be placed in the pipe at any time.

5. As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be secured in place with approved backfill material.

6. It is not mandatory to lay pipe with the bells facing the direction in which work is progressing.

7. Applying pressure to the top of the pipe, such as with a backhoe bucket, to lower the pipe to the proper elevation or grade, shall not be permitted.

8. Detection tape shall be buried 4 to 10-inches deep. Should detection tape need to be installed deeper, the Contractor shall provide 3-inch wide tape. In no case shall detection tape be buried greater than 20-inches from the finish grade surface.

C. Alignment and Gradient

1. Lay pipe straight in alignment and gradient or follow true curves as nearly as practicable. Do not deflect any joint more than the maximum deflection recommended by the manufacturer.

2. Maintain a transit, level and accessories on the job to lay out angles and ensure that deflection allowances are not exceeded.

D. Expediting of Work: Excavate, lay the pipe, and backfill as closely together as possible. Do not leave unjointed pipe in the trench overnight. Backfill and compact the trench as soon as possible after laying and jointing is completed. Cover the exposed end of the installed pipe each day at the close of work and at all other times when work is not in progress. If necessary to backfill over the end of an uncompleted pipe or accessory, close the end with a suitable plug, either push-on, mechanical joint, restrained joint or as approved by the Engineer.

E. Joint Assembly

1. Push-on, mechanical, flange and restrained type joints shall be assembled in accordance with the manufacturer's recommendations.

2. The Contractor shall inspect each pipe joint within 200 feet on either side of main line valves to insure 100 percent seating of the pipe spigot, except as noted otherwise.

3. Each restrained joint shall be inspected by the Contractor to ensure that it has been "homed" 100 percent.

4. The Contractor shall internally inspect each pipe joint to insure proper assembly for pipe 24-inches in diameter and larger after the pipe has been brought to final alignment.

F. Cutting Pipe: Cut ductile iron pipe using an abrasive wheel saw. Cut PVC pipe using a suitable saw; remove all burrs and smooth the end before jointing. The Contractor shall cut the pipe and bevel the end, as necessary, to provide the correct length of pipe necessary for installing the fittings, valves, accessories and closure pieces in the correct location. Only push-on or mechanical joint pipe shall be cut.

G. Polyethylene Encasement: Installation shall be in accordance with AWWA C105 and the manufacturer's instructions. All ends shall be securely closed with tape and all damaged areas shall be completely repaired to the satisfaction of the Engineer.

H. Valve and Fitting Installation

1. Prior to installation, valves shall be inspected for direction of opening, number of turns to open, freedom of operation, tightness of

pressure-containing bolting and test plugs, cleanliness of valve ports and especially seating surfaces, handling damage and cracks. Defective valves shall be corrected or held for inspection by the Engineer. Valves shall be closed before being installed.

2. Valves, fittings, plugs and caps shall be set and joined to the pipe in the manner specified in this Section for cleaning, laying and joining pipe, except that 12-inch and larger valves shall be provided with special support, such as treated timbers, crushed stone, concrete pads or a sufficiently tamped trench bottom so that the pipe will not be required to support the weight of the valve. Valves shall be installed in the closed position.

3. A valve box shall be provided on each underground valve. They shall be carefully set, centered exactly over the operating nut and truly plumbed. The valve box shall not transmit shock or stress to the valve. The bottom flange of the lower belled portion of the box shall be placed below the valve operating nut. This flange shall be set on brick, so arranged that the weight of the valve box and superimposed loads will bear on the base and not on the valve or pipe. Extension stems shall be installed where depth of bury places the operating nut in excess of 30-inches beneath finished grade so as to set the top of the operating nut 30-inches below finished grade. The valve box cover shall be flush with the surface of the finished area or such other level as directed by the Engineer.

4. In no case shall valves be used to bring misaligned pipe into alignment during installation. Pipe shall be supported in such a manner as to prevent stress on the valve.

5. A valve marker shall be provided for each underground valve. Unless otherwise detailed on the Drawings or directed by the Engineer, valve markers shall be installed 6-inches inside the right-of-way or easement.

I. Hydrant Installation

1. Prior to installation, inspect all hydrants for direction of opening, nozzle threading, operating nut and cap nut dimensions, tightness of pressure-containing bolting, cleanliness of inlet elbow, handling damage and cracks. Defective hydrants shall be corrected or held for inspection by the Engineer.

2. All hydrants shall stand plumb and shall have their nozzles parallel with or at right angles to the roadway, with pumper nozzle facing the roadway,

except that hydrants having two-hose nozzles 90 degrees apart shall be set with each nozzle facing the roadway at an angle of 45 degrees.

3. Hydrants shall be set to the established grade, with the centerline of the lowest nozzle at least 12-inches above the ground or as directed by the Engineer.

4. Each hydrant shall be connected to the main with a 6-inch branch controlled by an independent 6-inch valve. When a hydrant is set in soil that is pervious, drainage shall be provided at the base of the hydrant by placing coarse gravel or crushed stone mixed with coarse sand from the bottom of the trench to at least 6-inches above the drain port opening in the hydrant to a distance of 12-inches around the elbow.

5. When a hydrant is set in clay or other impervious soil, a drainage pit 2 x 2 x 2 feet shall be excavated below each hydrant and filled with coarse gravel or crushed stone mixed with coarse sand under and around the elbow of the hydrant and to a level of 6-inches above the drain port.

6. Hydrants shall be located as shown on the Drawings or as directed by the Engineer. In the case of hydrants that are intended to fail at the ground-line joint upon vehicle impact, specific care must be taken to provide adequate soil resistance to avoid transmitting shock moment to the lower barrel and inlet connection. In loose or poor load bearing soil, this may be accomplished by pouring a concrete collar approximately 6-inches thick to a diameter of 24-inches at or near the ground line around the hydrant barrel.

3.06 CONNECTIONS TO WATER MAINS

A. Make connections to existing pipe lines with tapping sleeves and valves, unless specifically shown otherwise on the Drawings.

B. Location: Before laying pipe, locate the points of connection to existing water mains and uncover as necessary for the Engineer to confirm the nature of the connection to be made.

C. Interruption of Services: Make connections to existing water mains only when system operations permit. Operate existing valves only with the specific authorization and direct supervision of the Owner.

D. Tapping Saddles and Tapping Sleeves

1. Holes in the new pipe shall be machine cut, either in the field or at the factory. No torch cutting of holes shall be permitted.

2. Prior to attaching the saddle or sleeve, the pipe shall be thoroughly cleaned, utilizing a brush and rag, as required.

3. Before performing field machine cut, the watertightness of the saddle or sleeve assembly shall be pressure tested. The interior of the assembly shall be filled with water. An air compressor shall be attached, which will induce a test pressure as specified in this Section. No leakage shall be permitted for a period of five minutes.

4. After attaching the saddle or sleeve to an existing main, but prior to making the tap, the interior of the assembly shall be disinfected. All surfaces to be exposed to potable water shall be swabbed or sprayed with a one percent hypochlorite solution.

E. Connections Using Solid Sleeves: Where connections are shown on the Drawings using solid sleeves, the Contractor shall furnish materials and labor necessary to make the connection to the existing pipe line.

F. Connections Using Couplings: Where connections are shown on the Drawings using couplings, the Contractor shall furnish materials and labor necessary to make the connection to the existing pipe line, including all necessary cutting, plugging and backfill.

3.07 VALVE BOX ADJUSTMENT (Not Used)

3.08 THRUST RESTRAINT

A. Provide restraint at all points where hydraulic thrust may develop.

B. Concrete Blocking

1. Provide concrete blocking for all bends, tees, valves, and other points where thrust may develop, except where other exclusive means of thrust restraint are specifically shown on the Drawings.

2. Concrete shall be as specified in this Section.

3. Form and pour concrete blocking at fittings as shown on the Drawings and as directed by the Engineer. Pour blocking against undisturbed earth. Increase dimensions when required by over excavation.

3.09 INSPECTION AND TESTING

A. Pressure and Leakage Test

1. All sections of the water main subject to internal pressure shall be pressure tested in accordance with AWWA C600. A section of main will be considered ready for testing after completion of all thrust restraint and backfilling.

2. Each segment of water main between main valves shall be tested individually.

3. Test Preparation

   a. For water mains less than 24-inches in diameter, flush sections thoroughly at flow velocities, greater than 2.5 feet per second, adequate to remove debris from pipe and valve seats. For water mains 24-inches in diameter and larger, the main shall be carefully swept clean, and mopped if directed by the Engineer. Partially open valves to allow the water to flush the valve seat.
   b. Partially operate valves and hydrants to clean out seats.
   c. Provide temporary blocking, bulkheads, flanges and plugs as necessary, to assure all new pipe, valves and appurtenances will be pressure tested.
   d. Before applying test pressure, air shall be completely expelled from the pipeline and all appurtenances. Insert corporation cocks at highpoints to expel air as main is filled with water as necessary to supplement automatic air valves. Corporation stops shall be constructed as detailed on the Drawings with a meter box.
   e. Fill pipeline slowly with water. Provide a suitable pump with an accurate water meter to pump the line to the specified pressure.
   f. The differential pressure across a valve or hydrant shall equal the maximum possible, but not exceed the rated working pressure. Where necessary, provide temporary backpressure to meet the differential pressure restrictions.
   g. Valves shall not be operated in either the opening or closing direction at differential pressures above the rated pressure.

4. Test Pressure: Test the pipeline at 50 psi above the rated working pressure measured at the lowest point for at least two hours. Maintain the test pressure within 5 psi of the specified test pressure for the test duration. Should the pressure drop more than 5 psi at any time during the test period,

the pressure shall be restored to the specified test pressure. Provide an accurate pressure gage with graduation not greater than 5 psi.

5. Leakage

   a. Leakage shall be defined as the sum of the quantity of water that must be pumped into the test section, to maintain pressure within 5 psi of the specified test pressure for the test duration plus water required to return line to test pressure at the end of the test. Leakage shall be the total cumulative amount measured on a water meter.
   b. The Owner assumes no responsibility for leakage occurring through existing valves.

6. Test Results: No test section shall be accepted if the leakage exceeds the limits determined by the following formula:

$$L = \frac{SD\,(P)^{1/2}}{133{,}200}$$

Where:
- L = allowable leakage, in gallons per hour
- S = length of pipe tested, in feet
- D = nominal diameter of the pipe, in inches
- P = average test pressure during the leakage test, in pounds per square inch (gauge)

As determined under Section 4 of AWWA C600.

If the water main section being tested contains lengths of various pipe diameters, the allowable leakage shall be the sum of the computed leakage for each diameter. The leakage test shall be repeated until the test section is accepted. All visible leaks shall be repaired regardless of leakage test results.

7. Completion: After a pipeline section has been accepted, relieve test pressure. Record type, size and location of all outlets on record drawings.

3.10 DISINFECTING PIPELINE

A. After successfully pressure testing each pipeline section, disinfect in accordance with AWWA C651 for the continuous-feed method and these Specifications.

B. Specialty Contractor: Disinfection shall be performed by an approved specialty contractor. Before disinfection is performed, the Contractor shall submit a written procedure for approval before being permitted to proceed with the disinfection. This plan shall also include the steps to be taken for the neutralization of the chlorinated water.

C. Chlorination

1. Apply chlorine solution to achieve a concentration of at least 50 milligrams per liter free chlorine in new line. Retain chlorinated water for 24 hours.

2. Chlorine concentration shall be recorded at every outlet along the line at the beginning and end of the 24 hour period.

3. After 24 hours, all samples of water shall contain at least 25 milligrams per liter free chlorine. Re-chlorinate if required results are not obtained on all samples.

D. Disposal of Chlorinated Water: Reduce chlorine residual of disinfection water to less than one milligram per liter if discharged directly to a body of water or to less than two milligrams per liter if discharged onto the ground prior to disposal. Treat water with sulfur dioxide or other reducing chemicals to neutralize chlorine residual. Flush all lines until residual is equal to existing system.

E. Bacteriological Testing: After final flushing and before the main is placed into service, the Contractor shall assist the Owner in collecting samples from the line to have tested for bacteriological quality. Testing shall be performed by the Owner at a laboratory certified by the State of Kentucky. Re-chlorinate lines until the required results are obtained.

3.11 PROTECTION AND RESTORATION OF WORK AREA

A. General: Return all items and all areas disturbed, directly or indirectly by work under these Specifications, to their original condition or better, as quickly as possible after work is started.

1. The Contractor shall plan, coordinate, and prosecute the work such that disruption to personal property and business is held to a practical minimum.

2. All construction areas abutting lawns and yards of residential or commercial property shall be restored promptly. Backfilling of underground facilities, ditches, and disturbed areas shall be accomplished on a daily basis as work is completed. Finishing, dressing, and grassing shall be accomplished immediately thereafter, as a continuous operation within each area being constructed and with emphasis placed on completing each individual yard or business frontage. Care shall be taken to provide positive drainage to avoid ponding or concentration of runoff.

3. Handwork, including raking and smoothing, shall be required to ensure that the removal of roots, sticks, rocks, and other debris is removed in order to provide a neat and pleasing appearance.

4. The Department of Transportation's engineer shall be authorized to stop all work by the Contractor when restoration and cleanup are unsatisfactory and to require appropriate remedial measures.

B. Man-Made Improvements: Protect, or remove and replace with the Engineer's approval, all fences, walkways, mail boxes, pipe lines, drain culverts, power and telephone lines and cables, property pins and other improvements that may be encountered in the Work.

C. Cultivated Growth: Do not disturb cultivated trees or shrubbery unless approved by the Engineer. Any such trees or shrubbery which must be removed shall be heeled in and replanted under the direction of an experienced nurseryman.

D. Cutting of Trees: Do not cut trees for the performance of the work except as absolutely necessary. Protect trees that remain in the vicinity of the work from damage from equipment. Do not store spoil from excavation against the trunks. Remove excavated material stored over the root system of trees within 30 days to allow proper natural watering of the root system. Repair any damaged tree over 3-inches in diameter, not to be removed, under the direction of an experienced nurseryman. All trees and brush that require removal shall be promptly and completely removed from the work area and disposed of by the Contractor. No stumps, wood piles, or trash piles will be permitted on the work site.

E. Disposal of Rubbish: Dispose of all materials cleared and grubbed during the construction of the Project in accordance with the applicable codes and rules of the appropriate county, state and federal regulatory agencies.

3.12 ABANDONING EXISTING WATER MAINS (Not Used)

END OF SECTION

SECTION 02933

Seeding

PART 1 GENERAL

1.1 SCOPE

A. The work covered by this section shall include the establishment of all ground cover including areas to be seeded and sodded. This work shall include the supply of all materials, labor, superintendence and maintenance as outlined in these specifications.

B. The part of the site not covered by roads, walks, building, etc. shall be seeded according to these specifications. The areas to be sodded shall include a three foot strip immediately adjacent to all roads, walks, and structures, etc.

PART 2 PRODUCTS

2.1 LIME

A. Agriculture lime shall be spread over the entire area to be planted at an average rate of one (1) ton per acre. One tillage operation shall incorporate both the lime and the fertilizer into the soil to a depth of four inches (4").

2.2 FERTILIZER

A. Two fertilizer materials shall be applied to all areas to be seeded. The first shall be complete commercial fertilizer with 1:2:2 ratio of nitrogen, phosphorus, and potassium. Eight hundred pounds (800 lbs) per acre of a 6-12-12 fertilizer, or equivalent amount of another 1:2:2 ratio fertilizer shall be used.

B. In addition to a complete fertilizer, a slowly available nitrogen fertilizer shall be applied. Two hundred fifty pounds (250 lbs.) per acre of area formaldehyde (38-0-0) shall be used.

C. Both fertilizer materials shall be free flowing and suitable for application with approved equipment. Each material shall conform to State fertilizer laws. Bagged fertilizer shall be delivered in sealed standard containers and shall bear the name, trademark, and warranty of the producer. The fertilizers shall be incorporated into the surface four inches (4") by tillage.

2.3 SEED

A. Grass seed shall be fresh, clean and new crop seed composed of the following varieties mixed in the proportion by weight as shown and shall be certified as to varietal purity. All seed shall be mixed by a dealer furnished in sealed standard containers, and tagged with the dealer's guaranteed statement of composition of mixture and percentage of purity and germination. All areas disturbed by construction activity shall be seeded within the following blend at a rate of two hundred pounds (200 lbs.) per acre (4.6 pounds per 1000 square feet).

B. The quality of seed shall conform to or exceed the minimum requirement for seed quality of the Kentucky Seed Improvement Association and shall meet or exceed the following standards for purity and germination:

Variety	Min% Purity/Germ	Wt.%	Seeding Rate Pounds Per Acre
Kentucky Bluegrass-Kenblue	98/80	20	40
Creeping Red Fescue-Pennlawn	98/85	70	140
Perennial Ryegrass	95/90	10	20

2.4 MULCH

A. Mulch for hydroseeding shall be natural wood cellulose fiber or wood pulp which disperses readily in water and which has no toxic effect when combined with seed or other materials. It shall be a commercially available product made for use in spray applicators. Wood cellulose mulch shall be applied at a rate of 1000 lbs. per acre when work is done in the spring or fall season as defined below and 1500 pounds per acre when work is done during summer months.

2.5 SOD

A. Sod shall be bluegrass sod strongly rooted and free of pernicious weeds. It shall be a uniform thickness of not more than 1 1/2" and shall have not less than 3/4" of soil. All sod shall be grown on a commercial turf farm and no pasture sod shall be acceptable. The source of the sod must be approved by the Engineer before it is cut for delivery.

PART 3 EXECUTION

3.1 PLANTING SEASON

A. The normal seasonal dates for seeding mixtures containing Kentucky Bluegrass or tall fescue shall be August 15 to October 15 and from the time the soil is workable in the spring to May 1. Seeding of a specified grass variety at times other than the normal seasonal dates must be approved by the Engineer. Seeding shall not be done during windy weather or when the ground is excessively wet, frozen or otherwise untillable.

3.2 SOIL PREPARATION

A. All areas shall be graded to surface drain as shown on the plans. The lime and fertilizer shall be applied at the rates specified above and tilled into the surface 4 inches with approved tillage equipment to provide a reasonably firm, but friable seedbed.

B. All areas to be seeded or sodded shall meet the specified grades, and be free of any weed or undesirable plant growth or debris.

C. Lime and fertilizer for all areas shall be applied at the rate specified and incorporated into the top four inches by approved tillage equipment. The seed and wood cellulose mulch shall then be mixed with adequate water to produce a slurry and then applied uniformly with a hydroseeder at the rates specified above. Any area inadequately covered shall be redone as directed by the Engineer.

3.3 MAINTENANCE OF SEEDED AREAS:

A. The Contractor shall maintain seeded areas until they have been mowed two times and then he shall repair eroded areas one time after the second mowing. Each mowing shall be when the grass is about four inches (4") high and cut back to about 2 1/2". After the second mowing, the Contractor shall notify the Engineer that he is ready to repair erosion damage so that an inspection can be scheduled when the erosion repair erosion damage so that an inspection can be scheduled when the erosion repair work is complete. Once the erosion areas have been filled with topsoil, fertilized, seeded and mulched and the work has been inspected and approved by the Engineer, the work under this section is complete. Any further erosion repair work necessary will be treated as an extra and shall be done only when authorized by the Engineer.

3.4 CARE DURING CONSTRUCTION

A. The Contractor shall be responsible for repair to turf areas damaged by his equipment or men until all work is accepted. Temporary haul roads and storage areas shall be tilled to depth of four inches (4") and fertilized, seeded and mulched as specified above.

END OF SECTION

SECTION 02957
Erosion Control and Stabilization

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes provisions for erosion control and stabilization.

PART 2 PRODUCTS

2.1 EROSION CONTROL

A. All drainage paths and swales to be cut, graded, and seeded prior to any utilities trenching.

B. All drainage paths and excavated areas to be mulched upon completion of seeding. Straw bales are to be staked perpendicular to flow in bottom of swale every 100 feet along drainage swale route. Straw bales to remain in swale route until a substantial growth of grass has been established. Straw bales are to be staked around all inlet rims where swale lines are excavated to route storm water flow into inlet.

C. Erosion control requires immediate seeding and mulching of any stripped and unvegetated areas, including unpaved right-of-ways.

2.2 SEEDING

A. A leguminous inoculated seed mixture shall be used for all seed areas. Class of seeding as follows:

1. Mixture A: shall be used for all drainage paths, swales, side slopes, and all other areas where existing lawn is disturbed during construction.

   Seed mixture shall be as follows:

   2 lbs./1000 sq. ft. - Chewings Fescue
   2 lbs./1000 sq. ft. - Kentucky Bluegrass
   2 lbs./1000 sq. ft. - Perennial Rye

   Seed shall be sown at a rate of 6 lbs. per 1000 sq. ft. of area.

2. Mixture B: shall be for all areas disturbed by excavation and re-grading as seasonal or temporary cover in bare areas.

Seed mixture shall be as follows:

1 lb./1000 sq. ft. - Perennial Rye
1 lb./1000 sq. ft. - Annual Rye

Seed shall be sown at a rate of 4 lbs. per 1000 sq. ft. of area.

3. Mixture C: shall be used for all lake or pond banks.

Seed mixture shall be as follows:

20% Perennial Ryegrass
15% Kentucky Bluegrass
15% Creeping Red Fescue
50% Nutri-Kote plus Apron fungicide seed coating.

Seed shall be sown at a rate of 5 lbs. per 1000 sq. ft. of area.

2.3 FERTILIZER

A. Apply a minimum of 600 lbs. of 12-12-12 fertilizer per acre.

2.4 MULCH

A. Mulch shall consist of clean, seed-free threshed straw of wheat, rye, oats, or barley. Spread mulch uniformly to form a continuous blanket not less than 1.5 inches loose measurement over "Mixture A" and "Mixture C" seeded areas.

B. The mulch shall be held in place by being mechanically crimped into the soil, tackified with a bio-degradable tackifier, or netted and stapled to the soil with degradable netting. The mulch should be applied at a minimum rate of 1500 lbs. per acre.

2.5 STRAW TACKIFIER - MULCH TACKIFIER

A. The tackifier shall be a naturally derived product from all organic sources resulting in a strong resilient muciloid, non-bitumen M-Binder. The product can be used in a hydro-seeder with both 100% Virgin Wood Fiber or Paper Wood Cellulose mulch and can be sprayed on 100% Wheat Straw Mulch for stabilization from the wind. Application rates vary between 60-140 lbs. per acre depending upon the existing conditions. The product shall be packed in 40 lbs. fiber bags.

Technical Specifications:

Protein Content	1.62
Ash Content	2.7
Fiber	4.0
pH of 1% Solution	6.8
Settleable Solids	5.0

B. Erosion control requires immediate seeding and mulching of any stripped and un-vegetated areas, including unpaved right-of-ways.

PART 3 (NOT USED)

END OF SECTION

SECTION 03300
Cast-in-place Concrete

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcing, mix design, placement procedures, and finishes.

B. Cast-in-place concrete includes the following:

1. Foundations and footings.
2. Slabs-on-grade.
3. Fill for steel deck.
4. Foundation walls.
5. Shear walls.
6. Load-bearing building walls.
7. Building frame members.
8. Equipment pads and bases.
9. Fill for steel pan stairs.

1.3 SUBMITTALS

A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.

B. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials, and others if requested by Engineer.

C. Shop drawings for reinforcement detailing fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, bent bar diagrams, and arrangement of concrete reinforcement. Include special reinforcing required for openings through concrete structures.

D. Shop drawings for formwork indicating fabrication and erection of forms for specific

finished concrete surfaces. Show form construction including jointing, special form joints or reveals, location and pattern of form tie placement, and other items that affect exposed concrete visually.

1. Engineer's review is for general applications and features only. Designing formwork for structural stability and efficiency is Contractor's responsibility.

E. Samples of materials as requested by Engineer, including names, sources, and descriptions, as follows:

1. Color finishes.
2. Normal weight aggregates.
3. Fiber reinforcement.
4. Reglets.
5. Waterstops.
6. Vapor retarder/barrier.
7. Form liners.

F. Laboratory test reports for concrete materials and mix design test.

G. Material certificates in lieu of material laboratory test reports when permitted by Engineer. Material certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

1.4 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:

1. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."
2. ACI 318, "Building Code Requirements for Reinforced Concrete."
3. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."

B. Concrete Testing Service: Engage a testing agency acceptable to Engineer to perform material evaluation tests and to design concrete mixes.

C. Materials and installed work may require testing and retesting at any time during progress of Work. Tests, including retesting of rejected materials for installed Work, shall be done at Contractor's expense.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.

B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or another acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Textured Finish Concrete: Units of face design, size, arrangement, and configuration to match control sample. Provide solid backing and form supports to ensure stability of textured form liners.

D. Forms for Cylindrical Columns and Supports: Metal, glass-fiber-reinforced plastic, or paper or fiber tubes that will produce smooth surfaces without joint indications. Provide units with sufficient wall thickness to resist wet concrete loads without deformation.

E. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to support weight of placed concrete without deformation.

F. Carton Forms: Biodegradable paper surface, treated for moisture-resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

G. Form Release Agent: Provide commercial formulation form release agent with a maximum of 350 g/L volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

H. Form Ties: Factory-fabricated, adjustable-length, stainless steel, removable or snap-off metal form ties designed to prevent form deflection and to prevent spalling of concrete upon removal. Provide units that will leave no metal closer than 1-1/2 inches (38 mm) to the plane of the exposed concrete surface.

1. Provide ties that, when removed, will leave holes not larger than 1 inch (25 mm) in diameter in the concrete surface. Use only stainless material.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615 Grade 60 (ASTM A 615M Grade 400), deformed.

B. Galvanized Reinforcing Bars: ASTM A 767 (ASTM A 767M), Class II [2.0 oz. zinc psf (610 g/sq. m)], hot-dip galvanized after fabrication and bending.

C. Epoxy-Coated Reinforcing Bars: ASTM A 775 (ASTM A 775M).

D. Steel Wire: ASTM A 82, plain, cold-drawn steel.

E. Welded Wire Fabric: ASTM A 185, welded steel wire fabric.

F. Deformed-Steel Welded Wire Fabric: ASTM A 497.

G. Epoxy-Coated Welded Wire Fabric: ASTM A 884, Class A.

H. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI specifications.

1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
2. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).

2.3 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I.

1. Use one brand of cement throughout Project.

B. Fly Ash: ASTM C 618, Type F.

C. Normal-Weight Aggregates: ASTM C 33 and as specified. Provide aggregates from a single source for exposed concrete.

1. For exposed exterior surfaces, do not use fine or coarse aggregates that contain substances that cause spalling.

2. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Engineer..

D. Lightweight Aggregates: ASTM C 330.

E. Water: Potable.

F. Fiber Reinforcement: Polypropylene fibers engineered and designed for secondary reinforcement of concrete slabs, complying with ASTM C 1116, Type III, not less than 3/4 inch long.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

a. Gilco Fibers, Cormix Construction Chemicals.
b. Durafiber, Durafiber Corp.
c. Fiberstrand 100, Euclid Chemical Co.
d. Fibermesh, Fibermesh Co., Div. Synthetic Industries, Inc.
e. Forta, Forta Corp.
f. Grace Fibers, W.R. Grace & Co.
g. Polystrand, Metalcrete Industries

G. Admixtures, General: Provide concrete admixtures that contain not more than 0.1 percent chloride ions.

H. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

a. Air-Tite, Cormix Construction Chemicals.
b. Air-Mix or Perma-Air, Euclid Chemical Co.
c. Darex AEA or Daravair, W.R. Grace & Co.
d. MB-VR or Micro-Air, Master Builders, Inc.
e. Sealtight AEA, W.R. Meadows, Inc.
f. Sika AER, Sika Corp.

I. Water-Reducing Admixture: ASTM C 494, Type A.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

a. Chemtard, ChemMasters Corp.
b. PSI N, Cormix Construction Chemicals.
c. Eucon WR-75, Euclid Chemical Co.
d. WRDA, W.R. Grace & Co.

e. Pozzolith Normal or Polyheed, Master Builders, Inc.
f. Metco W.R., Metalcrete Industries.
g. Prokrete-N, Prokrete Industries.
h. Plastocrete 161, Sika Corp.

J. High-Range Water-Reducing Admixture: ASTM C 494, Type F or Type G.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

a. Super P, Anti-Hydro Co., Inc.
b. Cormix 200, Cormix Construction Chemicals.
c. Eucon 37, Euclid Chemical Co.
d. WRDA 19 or Daracem, W.R. Grace & Co.
e. Rheobuild or Polyheed, Master Builders, Inc.
f. Superslump, Metalcrete Industries.
g. PSPL, Prokrete Industries.
h. Sikament 300, Sika Corp.

K. Water-Reducing, Accelerating Admixture: ASTM C 494, Type E.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

a. Q-Set, Conspec Marketing & Manufacturing Co.
b. Lubricon NCA, Cormix Construction Chemicals.
c. Accelguard 80, Euclid Chemical Co.
d. Daraset, W.R. Grace & Co.
e. Pozzutec 20, Master Builders, Inc.
f. Accel-Set, Metalcrete Industries.

L. Water-Reducing, Retarding Admixture: ASTM C 494, Type D.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

a. PSI-R Plus, Cormix Construction Chemicals.
b. Eucon Retarder 75, Euclid Chemical Co.
c. Daratard-17, W.R. Grace & Co.
d. Pozzolith R, Master Builders, Inc.
e. Protard, Prokrete Industries.
f. Plastiment, Sika Corporation.

2.4 RELATED MATERIALS

A. Reglets: Where sheet flashing or bituminous membranes are terminated in reglets, provide reglets of not less than 0.0217- inch- (0.46-mm-) thick galvanized sheet steel. Fill reglet or cover face opening to prevent intrusion of concrete or debris.

B. Dovetail Anchor Slots: Hot-dip galvanized sheet steel, not less than 0.0336 inch thick (0.76 mm) with bent tab anchors. Fill slot with temporary filler or cover face opening to prevent intrusion of concrete or debris.

C. Waterstops: Provide flat, dumbbell-type or centerbulb-type waterstops at construction joints and other joints as indicated. Size to suit joints.

D. Rubber Waterstops: Corps of Engineers CRD-C 513.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

    a. The Burke Co.
    b. Progress Unlimited.
    c. Williams Products, Inc.

E. Polyvinyl Chloride Waterstops: Corps of Engineers CRD-C 572.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

    a. The Burke Co.
    b. Greenstreak Plastic Products Co.
    c. W.R. Meadows, Inc.
    d. Progress Unlimited.
    e. Schlegel Corp.
    f. Vinylex Corp.

F. Sand Cushion: Clean, manufactured or natural sand.

G. Vapor Retarder: Provide vapor retarder that is resistant to deterioration when tested according to ASTM E 154, as follows:

1. Polyethylene sheet not less than 8 mils (0.2 mm) thick.

H. Vapor Barrier: Premolded seven-ply membrane consisting of reinforced core and carrier sheet with fortified bitumen layers, protective weathercoating, and plastic antistick sheet. Water vapor transmission rate of 1 perm when tested according to ASTM E 96, Method B. Provide manufacturer's recommended mastics and gusset tape.

1. Product: Subject to compliance with requirements, provide Sealtight Premoulded Membrane by W.R. Meadows, Inc.

I. Nonslip Aggregate Finish: Provide fused aluminum oxide granules or crushed emery as the abrasive aggregate for a nonslip finish, with emery aggregate containing not less than 50 percent aluminum oxide and not less than 25 percent ferric oxide. Use material that is factory-graded, packaged, rustproof, nonglazing, and unaffected by freezing, moisture, and cleaning materials.

J. Colored Wear-Resistant Finish: Packaged dry combination of materials consisting of portland cement, graded quartz aggregate, coloring pigments, and plasticizing admixture. Use coloring pigments that are finely ground nonfading mineral oxides interground with cement. Color as selected by Owner from manufacturers' standards, unless otherwise indicated.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

   a. Conshake 600 Colortone, Conspec Marketing & Mfg. Co.
   b. Floorcron, Cormix Construction Chemicals.
   c. Quartz Tuff, Dayton-Superior.
   d. Surflex, Euclid Chemical Co.
   e. Colorundum, A.C. Horn, Inc.
   f. Quartz Plate, L&M Construction Chemicals, Inc.
   g. Colorcron, Master Builders, Inc.
   h. Floor Quartz, Metalcrete Industries
   i. Lithochrome Color Hardener, L.M. Scofield Co.
   j. Harcol Redi-Mix, Sonneborn-Chemrex.
   k. Hard Top, Symons Corp.

K. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m), complying with AASHTO M 182, Class 2.

L. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.

1. Waterproof paper.
2. Polyethylene film.
3. Polyethylene-coated burlap.

M. Liquid Membrane-Forming Curing Compound: Liquid-type membrane-forming curing compound complying with ASTM C 309, Type I, Class A. Moisture loss not more than 0.55 kg/sq. m when applied at 200 sq. ft./gal (4.9 sq. m/L).

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

   a. A-H 3 Way Sealer, Anti-Hydro Co., Inc.
   b. Spartan-Cote, The Burke Co.
   c. Conspec #1, Conspec Marketing & Mfg. Co.
   d. Sealco 309, Cormix Construction Chemicals.
   e. Day-Chem Cure and Seal, Dayton Superior Corp.
   f. Eucocure, Euclid Chemical Co.
   g. Horn Clear Seal, A.C. Horn, Inc.
   h. L&M Cure R, L&M Construction Chemicals, Inc.
   i. Masterkure, Master Builders, Inc.
   j. CS-309, W.R. Meadows, Inc.
   k. Seal N Kure, Metalcrete Industries.
   l. Kure-N-Seal, Sonneborn-Chemrex.
   m. Stontop CS2, Stonhard, Inc.

N. Water-Based Acrylic Membrane Curing Compound: ASTM C 309, Type I, Class B.

1. Provide material that has a maximum volatile organic compound (VOC) rating of 350 g/L.
2. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

   a. Highseal, Conspec Marketing and Mfg. Co.
   b. Sealco - VOC, Cormix Construction Chemicals.
   c. Safe Cure and Seal, Dayton Superior Corp.
   d. Aqua-Cure, Euclid Chemical Co.
   e. Dress & Seal WB, L&M Construction Chemicals, Inc.
   f. Masterkure 100W, Master Builders, Inc.
   g. Vocomp-20, W.R. Meadows, Inc.
   h. Metcure, Metalcrete Industries.
   i. Stontop CS1, Stonhard, Inc.

O. Evaporation Control: Monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

a. Aquafilm, Conspec Marketing and Mfg. Co.
b. Eucobar, Euclid Chemical Co.
c. E-Con, L&M Construction Chemicals, Inc.
d. Confilm, Master Builders, Inc.
e. Waterhold, Metalcrete Industries.

P. Underlayment Compound: Free-flowing, self-leveling, pumpable, cement-based compound for applications from 1 inch (25 mm) thick to feathered edges.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

a. K-15, Ardex, Inc.
b. Self-Leveling Wear Topping, W.R. Bonsal Co.
c. Conflow, Conspec Marketing and Mfg. Co.
d. Corlevel, Cormix Construction Chemicals.
e. LevelLayer II, Dayton Superior Corp.
f. Flo-Top, Euclid Chemical Co.
g. Gyp-Crete, Gyp-Crete Corp.
h. Levelex, L&M Construction Chemicals, Inc.
i. Underlayment 110, Master Builders, Inc.
j. Stoncrete UL1, Stonhard, Inc.
k. Concrete Top, Symons Corp.
l. Thoro Underlayment Self-Leveling, Thoro System Products.

Q. Bonding Agent: Polyvinyl acetate or acrylic base.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

a. Polyvinyl Acetate (Interior Only):

1) Superior Concrete Bonder, Dayton Superior Corp.
2) Euco Weld, Euclid Chemical Co.
3) Weld-Crete, Larsen Products Corp.

4) Everweld, L&M Construction Chemicals, Inc.
5) Herculox, Metalcrete Industries.
6) Ready Bond, Symons Corp.

b. Acrylic or Styrene Butadiene:

1) Acrylic Bondcrete, The Burke Co.
2) Strongbond, Conspec Marketing and Mfg. Co.
3) Day-Chem Ad Bond, Dayton Superior Corp.
4) SBR Latex, Euclid Chemical Co.
5) Daraweld C, W.R. Grace & Co.
6) Hornweld, A.C. Horn, Inc.
7) Everbond, L&M Construction Chemicals, Inc.
8) Acryl-Set, Master Builders Inc.
9) Intralok, W.R. Meadows, Inc.
10) Acrylpave, Metalcrete Industries.
11) Sonocrete, Sonneborn-Chemrex.
12) Stonlock LB2, Stonhard, Inc.
13) Strong Bond, Symons Corp.

R. Epoxy Adhesive: ASTM C 881, two-component material suitable for use on dry or damp surfaces. Provide material type, grade, and class to suit Project requirements.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

a. Burke Epoxy M.V., The Burke Co.
b. Spec-Bond 100, Conspec Marketing and Mfg. Co.
c. Resi-Bond (J-58), Dayton Superior.
d. Euco Epoxy System #452 or #620, Euclid Chemical Co.
e. Epoxtite Binder 2390, A.C. Horn, Inc.
f. Epabond, L&M Construction Chemicals, Inc.
g. Concresive Standard Liquid, Master Builders, Inc.
h. Rezi-Weld 1000, W.R. Meadows, Inc.
i. Metco Hi-Mod Epoxy, Metalcrete Industries.
j. Sikadur 32 Hi-Mod, Sika Corp.
k. Stonset LV5, Stonhard, Inc.
l. R-600 Series, Symons Corp.

2.5 PROPORTIONING AND DESIGNING MIXES

A. Prepare design mixes for each type and strength of concrete by either laboratory trial

batch or field experience methods as specified in ACI 301. For the trial batch method, use an independent testing agency acceptable to Engineer for preparing and reporting proposed mix designs.

1. Do not use the same testing agency for field quality control testing.
2. Limit use of fly ash to not exceed 25 percent of cement content by weight.

B. Submit written reports to Engineer of each proposed mix for each class of concrete prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed.

C. Design mixes to provide normal weight concrete with the following properties as indicated on drawings and schedules:

1. 4000 psi (27.6 MPa), 28-day compressive strength; water-cement ratio, 0.44 maximum (non-air-entrained), 0.35 maximum (air-entrained).

D. Water-Cement Ratio: Provide concrete for following conditions with maximum water-cement (W/C) ratios as follows:

1. Subjected to freezing and thawing: W/C 0.45.
2. Subjected to deicers/watertight: W/C 0.40.
3. Subjected to brackish water, salt spray, or deicers: W/C 0.40.

E. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

1. Ramps, slabs, and sloping surfaces: Not more than 3 inches (75 mm).

2. Reinforced foundation systems: Not less than 1 inch (25 mm) and not more than 3 inches (75 mm).
3. Concrete containing high-range water-reducing admixture (superplasticizer): Not more than 8 inches (200 mm) after adding admixture to site-verified 2 - 3 inch (50 - 75 mm) slump concrete.
4. Other concrete: Not more than 4 inches (100 mm).

F. Lightweight Structural Concrete: Lightweight aggregate and concrete shall conform to ASTM C 330. Proportion mix to produce concrete with a minimum compressive strength of 3000 psi (20.7) at 28 days and a calculated equilibrium unit weight of 110 pcf (1762 kg/cu. m) plus or minus 3 pcf (48.1 kg/cu. m) as determined by ASTM C 567. Concrete slump at the point of placement shall be the minimum necessary for efficient mixing, placing, and finishing. Maximum slump shall be 6 inches (150 mm) for pumped

concrete and 5 inches (125 mm) elsewhere. Air entrain concrete exposed to weather according to ACI 301 requirements.

G. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Engineer. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Engineer before using in Work.

H. Fiber Reinforcement: Add at manufacturer's recommended rate but not less than 1.5 lb/cu. yd. (0.9 kg/cu. m).

2.6 ADMIXTURES

A. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.

B. Use accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg F (10 deg C).

C. Use high-range water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs, architectural concrete, parking structure slabs, concrete required to be watertight, and concrete with water-cement ratios below 0.50.

D. Use air-entraining admixture in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus or minus 1-1/2 percent within the following limits:

1. Concrete structures and slabs exposed to freezing and thawing, deicer chemicals, or hydraulic pressure:

    a. 4.5 percent (moderate exposure); 5.5 percent (severe exposure) for 1-1/2 inch (38 mm) maximum aggregate.
    b. 4.5 percent (moderate exposure); 6.0 percent (severe exposure) for 1 inch (25 mm) maximum aggregate.
    c. 5.0 percent (moderate exposure); 6.0 percent (severe exposure) for 3/4 inch (19 mm) maximum aggregate.
    d. 5.5 percent (moderate exposure); 7.0 percent (severe exposure) for 1/2 inch (13 mm) maximum aggregate.

2. Other concrete not exposed to freezing, thawing, or hydraulic pressure, or to

receive a surface hardener: 2 to 4 percent air.

E. Use admixtures for water reduction and set accelerating or retarding in strict compliance with manufacturer's directions.

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with requirements of ASTM C 94, and as specified.

1. When air temperature is between 85 deg F (29 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate the installation of joint materials, vapor retarder/barrier, and other related materials with placement of forms and reinforcing steel.

3.2 FORMS

A. General: Design, erect, support, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 347 limits:

1. Provide Class A tolerances for concrete surfaces exposed to view.
2. Provide Class C tolerances for other concrete surfaces.

B. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the Work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.

C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like for easy removal.

D. Provide temporary openings for clean-outs and inspections where interior area of formwork is inaccessible before and during concrete placement. Securely brace temporary openings and set tightly to forms to prevent losing concrete mortar. Locate temporary openings in forms at inconspicuous locations.

E. Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

F. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

G. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

3.3 VAPOR RETARDER/BARRIER INSTALLATION

A. General: Place vapor retarder/barrier sheeting in position with longest dimension parallel with direction of pour.

B. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended mastic or pressure-sensitive tape.

1. Cover vapor retarder/barrier with sand cushion and compact to depth indicated.

3.4 PLACING REINFORCEMENT

A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as specified.

1. Avoiding cutting or puncturing vapor retarder/barrier during reinforcement placement and concreting operations. Repair damages before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved.

D. Place reinforcement to maintain minimum coverages as indicated for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.5 JOINTS

A. Construction Joints: Locate and install construction joints so they do not impair strength or appearance of the structure.

B. Provide keyways at least 1-1/2 inches (38 mm) deep in construction joints in walls and slabs and between walls and footings. Bulkheads designed and accepted for this purpose may be used for slabs.

C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as indicated otherwise. Do not continue reinforcement through sides of strip placements.

D. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.

E. Waterstops: Provide waterstops in construction joints as indicated. Install waterstops to form continuous diaphragm in each joint. Support and protect exposed waterstops during progress of Work. Field-fabricate joints in waterstops according to manufacturer's printed instructions.

F. Isolation Joints in Slabs-on-Grade: Construct isolation joints in slabs-on-grade at points of contact between slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

G. Contraction (Control) Joints in Slabs-on-Grade: Construct contraction joints in slabs-on-grade to form panels of patterns as shown. Use saw cuts 1/8 inch (3 mm) wide by one-

fourth of slab depth or inserts 1/4 inch (6 mm) wide by one-fourth of slab depth, unless otherwise indicated.

1. Form contraction joints by inserting premolded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.

2. Contraction joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.

3. If joint pattern is not shown, provide joints not exceeding 15 ft. (4.5 m) in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays).
4. Provide joint fillers and sealants.

3.6 INSTALLING EMBEDDED ITEMS

A. General: Set and build into formwork anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached.

B. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, relieving angles, and other conditions.

C. Install dovetail anchor slots in concrete structures as indicated on drawings.

D. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

3.7 PREPARING FORM SURFACES

A. General: Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before placing reinforcement.

B. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer's instructions.

1. Coat steel forms with a nonstaining, rust-preventative material. Rust-stained steel formwork is not acceptable.

3.8 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. General: Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified.

C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location.

D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 24 inches (600 mm) and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.
2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate.

E. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until completing placement of a panel or section.

1. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.
2. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

3. Maintain reinforcing in proper position on chairs during concrete placement.

F. Cold-Weather Placement: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

G. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.

1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
2. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

H. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C). Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.
4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions.

3.9 FINISHING FORMED SURFACES

A. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch (6 mm) in height rubbed down or chipped off.

B. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or

a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or another similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.

C. Smooth-Rubbed Finish: Unless otherwise shown or scheduled, provide smooth-rubbed finish on all exposed, vertical concrete surfaces that have received smooth-formed finish treatment not later than 1 day after form removal.

1. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

D. Grout-Cleaned Finish: Provide grout-cleaned finish on scheduled concrete surfaces that have received smooth-formed finish treatment.

1. Combine one part portland cement to one and one-half parts fine sand by volume, and a 50:50 mixture of acrylic or styrene butadiene-based bonding admixture and water to form the consistency of thick paint. Blend standard portland cement and white portland cement in amounts determined by trial patches so that final color of dry grout will match adjacent surfaces.
2. Thoroughly wet concrete surfaces, apply grout to coat surfaces, and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

E. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 MONOLITHIC SLAB FINISHES

A. Scratch Finish: Apply scratch finish to monolithic slab surfaces to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and where indicated.

1. After placing slabs, finish surface to tolerances of F(F) 15 (floor flatness) and F(L) 13 (floor levelness) measured according to ASTM E 1155 (ASTM E 1155M). Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushes, brooms, or rakes.

B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as specified; slab surfaces to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo; and where indicated.

1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Finish surfaces to tolerances of F(F) 18 (floor flatness) and F(L) 15 (floor levelness) measured according to ASTM E 1155 (ASTM E 1155M). Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

C. Trowel Finish: Apply a trowel finish to monolithic slab surfaces exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or another thin film-finish coating system.

1. After floating, begin first trowel-finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and finish surfaces to tolerances of F(F) 20 (floor flatness) and F(L) 17 (floor levelness) measured according to ASTM E 1155 (ASTM E 1155M). Grind smooth any surface defects that would telegraph through applied floor covering system.

D. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply a trowel finish as specified, then immediately follow by slightly scarifying the surface with a fine broom.

E. Nonslip Broom Finish: Apply a nonslip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with before application.

F. Nonslip Aggregate Finish: Apply nonslip aggregate finish to concrete stair treads, platforms, ramps, sloped walks, and where indicated.

1. After completing float finishing and before starting trowel finish, uniformly spread dampened nonslip aggregate at a rate of 25 lb per 100 sq. ft. (12 kg/10 sq. m) of

surface. Tamp aggregate flush with surface using a steel trowel, but do not force below surface. After broadcasting and tamping, apply trowel finishing as specified.

2. After curing, lightly work surface with a steel wire brush or an abrasive stone, and water to expose nonslip aggregate.

3.11 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in safety inserts and accessories as shown on drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.12 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.

C. Curing Methods: Cure concrete by curing compound, by moist curing, by moisture-retaining cover curing, or by combining these methods, as specified.

D. Provide moisture curing by the following methods:

1. Keep concrete surface continuously wet by covering with water.
2. Use continuous water-fog spray.
3. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a 4 inch (100 mm) lap over adjacent absorptive covers.

E. Provide moisture-retaining cover curing as follows:

1. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches (75 mm) and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

F. Apply curing compound on exposed interior slabs and on exterior slabs, walks, and curbs as follows:

1. Apply curing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
2. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.

G. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

H. Curing Unformed Surfaces: Cure unformed surfaces, including slabs, floor topping, and other flat surfaces, by applying the appropriate curing method.

1. Final cure concrete surfaces to receive finish flooring with a moisture-retaining cover, unless otherwise directed.

3.13 SHORES AND SUPPORTS

A. General: Comply with ACI 347 for shoring and reshoring in multistory construction, and as specified.

B. Extend shoring from ground to roof for structures four stories or less, unless otherwise permitted.

C. Extend shoring at least three floors under floor or roof being placed for structures over four stories. Shore floor directly under floor or roof being placed, so that loads from construction above will transfer directly to these shores. Space shoring in stories below this level in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members where no reinforcing steel is provided. Extend shores beyond minimums to ensure proper distribution of loads throughout structure.

D. Remove shores and reshore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate reshoring to support work without excessive stress or deflection.

E. Keep reshores in place a minimum of 15 days after placing upper tier, or longer, if required, until concrete has attained its required 28-day strength and heavy loads due to construction operations have been removed.

3.14 REMOVING FORMS

A. General: Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.

B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed in less than 14 days or until concrete has attained at least 75 percent of design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.

C. Form-facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

3.15 REUSING FORMS

A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use patched forms for exposed concrete surfaces except as acceptable.

3.16 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable.

B. Mix dry-pack mortar, consisting of one part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh (1.2 mm) sieve, using only enough water as required for handling and placing.

1. Cut out honeycombs, rock pockets, voids over 1/4 inch (6 mm) in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than 1 inch (25 mm). Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with bonding agent. Place patching mortar before bonding agent has dried.
2. For surfaces exposed to view, blend white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

C. Repairing Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Owner. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.

1. Repair concealed formed surfaces, where possible, containing defects that affect the concrete's durability. If defects cannot be repaired, remove and replace the concrete.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.

1. Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects include crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to the reinforcement or completely through nonreinforced sections regardless of width, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.

2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.
3. Correct low areas in unformed surfaces during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable.
4. Repair defective areas, except random cracks and single holes not exceeding 1 inch (25 mm) in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least 3/4 inch (19 mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and
finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

E. Repair isolated random cracks and single holes 1 inch (25 mm) or less in diameter by dry-pack method. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Place dry-pack before bonding agent has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

F. Perform structural repairs with prior approval of Engineer for method and procedure, using specified epoxy adhesive and mortar.

G. Repair methods not specified above may be used, subject to acceptance of Engineer.

3.17 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. General: The Owner will employ a testing agency to perform tests and to submit test reports.

B. Sampling and testing for quality control during concrete placement may include the following, as directed by Engineer.

1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.

    a. Slump: ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.

    b. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231, pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.

    c. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4 deg C) and below, when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.

    d. Compression Test Specimen: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.

    e. Compressive-Strength Tests: ASTM C 39; one set for each day's pour exceeding 5 cu. yd. (4 cu. m) plus additional sets for each 50 cu. yd. (38 cu. m) more than the first 25 cu. yd. (19 cu. m) of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

2. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.
3. When total quantity of a given class of concrete is less than 50 cu. yd. (38 cu. m), Engineer may waive strength testing if adequate evidence of satisfactory strength is provided.
4. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
5. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi (3.4 MPa).

C. Test results will be reported in writing to Engineer within 3 days. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-

day tests and 28-day tests.

D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

E. Additional Tests: The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

END OF SECTION

SECTION 13210
Elevated Water Tank

PART 1 GENERAL

1.01 SCOPE

The Contractor shall be responsible for all labor, materials and equipment necessary for the design, fabrication, construction, painting, disinfection and testing of an elevated welded steel water storage tank supported by a series of supporting columns and cross bracing. This style of tank is commonly referred to as a "Multi-Column" Tank. Design and construction of the Elevated Tank shall conform to all requirements of AWWA D100 Standard for Welded Steel Tanks for Water Storage except as modified by the requirements of these contract documents.

1.02 QUALITY ASSURANCE

The design and construction of the "Multi-Column" elevated water storage tank shall only be undertaken by a Contractor with a minimum of five years experience with elevated tank construction. The Contractor must be able to demonstrate experience through the design and construction of at least five "Multi-Column" elevated water tanks. The Contractor shall not subcontract either the design or erection of the steel tank and support structure.

1.03 DESIGN STANDARDS

All work on the water storage tank shall fully conform to the requirements of the latest published editions of the following Standard Specifications:

1. AWWA (American Water Works Association) D100 Standard for Welded Steel Tanks for Water Storage.
2. AWWA D102 - Standard for Painting Steel Water Storage Tanks.
3. AWWA C652 - Standard for Disinfection of Water Storage Facilities.
4. AWS (American Welding Society)
5. NSF (National Sanitation Foundation) 61 - Materials in contact with Potable Water.
6. Steel Structures Painting Council Manual - Volume 1 - Good Painting Practice.
7. Steel Structures Painting Council Manual - Volume 2 - Systems and Specifications.
8. ACI 318 - Building Code Requirements for Reinforced Concrete
9. ACI 301 – Standard Specification for Structural Concrete

1.04 SUBMITTALS

A. Submit shop drawings and engineering data in accordance with the requirements of Section 01340 of these specifications.

B. After contract award and prior to construction, the Contractor shall provide working drawings and design calculations for the elevated steel tank and the foundation. Drawings shall show the size and location of all structural components and reinforcement, the required strength and grade of all materials, and the size and arrangement of principle piping and equipment. The drawings and calculations shall bear the certification of a professional Engineer licensed in the State of Kentucky. The design coefficients and resultant loads for snow, wind and seismic forces, and the methods of analysis shall be documented.

PART 2 PRODUCTS

2.01 GENERAL

The structural design of the elevated storage tank shall conform to the following design standards except as modified or clarified as follows:

a. Foundations – AWWA D100 and ACI 318 – Building Code Requirements for reinforced concrete.
b. Steel Tank – AWWA D100
c. Steel Tank Painting – AWWA D102

2.02 TANK DETAILS

The elevated tank shall be all-welded construction of the most economical design. All members of structural steel or of reinforced concrete shall be designed to safely withstand the maximum stresses to which they may be subjected during erection and operation.

1. The minimum operating capacity of the storage tank will be ***250,000*** US gallons.
2. The capacity of the tank, low to high water level, shall be contained within a maximum operating range of ***25'- 6"***.

2.03 LOADS

A. Seismic Load

Design in accordance with AWWA D100-96, Section 13. The following factors shall be used:

Z= 0.75 (Seismic Zone Factor)

All other factors shall be in accordance with Section 13.

B. Wind Load

Wind pressure shall be determined in accordance with AWWA D100-96, Section 3.1.4 for a 100 MPH wind velocity. For tanks located in coastal regions, Owner's Engineer shall consider use of increased wind load.

C. Snow Load

Snow load shall be determined in accordance with AWWA D100-96, Section 3.1.3 for 25 psf minimum loading.

2.04 FOUNDATION

A Geotechnical investigation has been carried out at the site and a copy of the report is included with the Contract Documents. Allowable bearing capacities are defined in this report. The Contractor shall retain the services of the Geotechnical consultant to verify the adequacy of the bearing stratum after the Contractor has carried out the excavation and before any concrete or reinforcement is placed. The concrete foundation shall be designed by the Contractor based upon the recommendations in the Geotechnical report.

2.05 STEEL TANK

A. General

The materials, design, fabrication, erection, welding, testing and inspection of the steel tank shall be in accordance with the applicable sections of AWWA D100 except as modified in this document.

B. Minimum Plate Thickness

The minimum thickness for any part of the structure shall be 3/16 inch for parts not in contact with water and 1/4 inch for parts in contact with water. All portions of the tank including the roof shall be of watertight construction.

2.06 ACCESSORIES

A. General

The following accessories shall be provided in accordance with these specifications. All items shall be in full conformity with the current applicable OSHA safety regulations and the operating requirements of the structure.

B. Ladders

Access ladders shall be provided at the following locations:

a) The tower ladder shall extend up one column from near the base connecting with the balcony. The first rung shall be located approximately 8 feet above top of foundation.
b) An outside tank ladder from the balcony to the roof hatch.
c) An inside tank ladder from the roof hatch to the inside bottom of the tank.
d) An inside riser ladder from the base of the riser to the bottom of the tank.

Ladder side rails shall be a minimum 3/8 inch by 2 inches with a 16 inch clear spacing. Rungs shall be not less than 3/4 inch, round or square, spaced at 12 inch centers. The surface of the rungs shall be knurled, dimpled or otherwise treated to minimize slipping. Ladders shall be secured to adjacent structures by brackets located at intervals not exceeding 10 feet. Brackets shall be of sufficient length to provide a minimum distance of 7 inches from the center of the rung to the nearest permanent object behind the ladder.

C. Fall Protection

Ladders shall be equipped with a fall arrest system meeting OSHA regulations. The system shall be supplied complete with safety harnesses, locking mechanisms, lanyards and accessories for two persons.

D. Balcony

The tank shall be equipped with a balcony not less than 30" wide with a handrail not less than 42" high. The floor shall be perforated for drainage.

2.07 OPENINGS

A. Roof Hatches

Provide two access hatches on the roof of the tank. One hatch shall be 30 inch diameter and allow access from the roof to the interior of the tank. The hatch will be hinged and equipped with a hasp for locking. The hatch cover shall have a 2 inch downward edge. The second hatch will be 24 inch diameter and flanged with a removable cover so constructed that an exhaust fan may be connected for ventilation during painting operations. The openings shall have a minimum 4 inch curb.

B. Tank Vent

The tank vent should be centrally located on the tank roof above the maximum weir crest elevation. The tank vent shall have an intake and relief capacity sufficiently large that excessive pressure or vacuum will not develop during maximum flow rate. The vent shall be designed, constructed and screened so as to prevent the ingress of wind driven debris, insects, birds and animals. The vent shall be designed to operate when frosted over or otherwise clogged. The screens or relief material shall not be damaged by the occurrence and shall return automatically to operating position after the blockage is cleared.

C. Riser Manhole

A minimum 14 x 18 inch elliptical access manhole shall be provided approximately 3 feet above the base of the wet riser. The hatch shall open inward.

2.08 RISER

The diameter of the wet riser shall be not less than 5 feet.

2.09 PIPING

A. Inlet and Outlet Piping

The vertical inlet and outlet pipe connection to the bottom of the riser shall be a *8* inch standard weight carbon steel pipe with appropriate transition to a base elbow of the same diameter. The vertical outlet pipe shall extend up into the riser one foot above the riser base.

B. **Overflow**

The overflow pipe shall be designed to carry the maximum design flow rate of ***800*** GPM. The ***8*** inch steel overflow pipe shall have a minimum wall thickness of 1/4". A suitable weir shall be provided inside the tank with the crest located at High Water Level. The overflow shall be routed from the weir to closely match the roof contour and extend down the ladder column and terminate approximately 1 to 2 feet above grade and discharge onto a concrete splash pad. The point of discharge shall have a 45 degree elbow to and be equipped with a stainless steel screen.

2.10 IDENTIFICATION PLATE

A tank identification plate shall be mounted on the tank riser pipe above the access manhole. The identification plate shall be corrosion resistant and contain the following information.

a) Tank Contractor
b) Contractor's project or file number
c) Tank capacity
d) Height to High Water Level
e) Date erected

PART 3 EXECUTION

3.01 CONCRETE FOUNDATION

The foundation shall be designed and constructed to safely and permanently support the structure. The basis of the foundation construction shall be commensurate with the soils investigation data included herein at the end of these specifications. The concrete foundation shall be constructed in accordance with ACI 301. Minimum concrete compressive strength shall be as specified in Section 03300 , "Cast-In-Place Concrete".

3.02 STEEL TANK CONSTRUCTION

A. **General**

The erection of the steel tank shall comply with the requirements of Section 10 of AWWA D100 except as modified by these documents.

B. Welding

All shop and field welding shall conform to AWS and AWWA D100, Section 10. Before any welding is performed, the constructor shall make certain that the welders or welding operators have their credentials for acceptance.

C. Fabrication

All fabrication and shop assembly shall conform to the requirements of AWWA D100, Section 9, Shop Fabrication.

D. Erection

Plates subjected to stress by the weight or pressure of the contained liquid shall be assembled and welded in such a manner that the proper curvature of the plates in both directions is maintained. Plates shall be assembled and welded together by a procedure that will result in a minimum of distortion from weld shrinkage.

E. Testing

Testing for both shop and field welds shall be in accordance with AWWA D100, Section 11, Inspection and Testing. All testing shall be performed prior to interior and exterior field painting. The testing shall be performed by an independent testing agency with all costs included in the Contractor's bid and paid by the Contractor.

F. Roof Lap Joints

All interior lap joints shall be sealed by means of caulking or continuous seal welding. This shall include penetrations of roof accessories.

3.03 COATING SYSTEM

A. Materials

1. All materials specified herein are manufactured by the TNEMEC Co., Inc., North Kansas City, Missouri (Local Contact (859) 296-2853 and are approved for use on this project.

2. Equivalent materials of other manufacturers may be substituted on approval of the ENGINEER. Requests for substitution shall include Manufacturer's literature for each product giving the name, generic type, descriptive information and evidence of satisfactory past performance on water tanks. Submittals shall include the following performance data as certified by a qualified testing laboratory:

    1. ASTM B117 - Method of Salt Spray (Fog) Testing
    2. ASTM D149 - Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials of Commercial Power Frequencies.
    3. ASTM D3359 - Method for Measuring Adhesion by Test Tape.
    4. ASTM D3363 - Method for Film Hardness by Pencil Test.
    5. ASTM D4060 - Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
    6. ASTM D4541 - Method for Pulling-off Strength of Coats Using Portable Adhesion Testers.
    7. ASTM D4585 - Practice for Testing the Water Resistance of Coatings Using Controlled Condensation.
    8. ASTM G53 - Practice for Operating Light and Water Exposure of Nonmetallic Materials.
    9. AWWA D102 - Standard for Painting Steel Water Storage Tanks.
    10. SSPC-SP10 - Near White Blast Cleaning.
    11. SSPC Sp-6 - Commercial Blast Cleaning.

B. <u>Surface Preparation</u>

After fabrication, all interior surfaces shall be shop cleaned in accordance with Steel Structures Painting Council Surface Preparation Specifications No. 10 "Near White" blast cleaning. All exterior surfaces shall be shop cleaned in accordance with SSPC Surface Preparation Specification No. 6 "Commercial Blast Cleaning". After cleaning all surfaces shall be thoroughly and completely cleaned of any residue or dust.

After the tank is erected, welded, and tested, the seams and adjacent areas shall be cleaned of all slag and splatter from the welding and all surfaces that were shop primed shall be cleaned of all dirt and foreign matter.

All welded seams, abraded spots and areas not shop primed shall be cleaned in accordance with SSPC No. 10 for interior surfaces and SSPC No. 6 for exterior surfaces.

C. Application

All materials shall be brought to the job site in the original sealed and labeled containers of the paint manufacturer indicating that the quantity of each coating purchased was sufficient to properly coat all surfaces. Such certification shall make reference to the square footage figures provided to the manufacturer and the Engineer by the Contractor. Colors shall be selected by the Owner.

The Contractor shall apply each coating at the rate and in the manner specified by the manufacturer. If material has thickened or must be diluted, the coating shall be built up to the same film thickness achieved with undiluted material. Deficiencies in film thickness shall be corrected by the application of additional coat(s) of paint. Where thinning is necessary, only products of the manufacturer furnishing the paint, and for the particular purpose, shall be allowed. All thinning shall be done strictly in accordance with the manufacturer's instructions, as well as with the full knowledge and approval of the Engineer.

No paint shall be applied when the surrounding air temperature, as measured in the shade, is below 40 degrees Fahrenheit. No paint shall be applied when the temperature of the surface to be painted is below 50 degrees Fahrenheit. Paint shall not be applied to wet or damp surfaces, and shall not be applied in the rain, fog or mist, or when the relative humidity will exceed 85%. No paint shall be applied when it is expected that the relative humidity will exceed 70% or that the air temperature will drop below 40 degrees Fahrenheit within 18 hours after the application of the paint. Dew or moisture condensation shall be anticipated, and if such conditions are prevalent, painting shall be delayed until mid-morning to be certain that the surface is dry. Further, the days painting shall be completed well in advance of the probable time of day when condensation occurs, in order to permit the film an appreciable drying time prior to the formation of moisture.

D. Interior Coating System

a. Shop Primer Coat

1. Immediately after blasting and before any rusting occurs (within 12 hours maximum) apply one (1) coat of TNEMEC Series 91 H_2O Hydro Zinc Primer to unpainted areas. This coating to be applied to 2.0 - 3.0 mils dry film thickness.

b. Field Stripe Coat

1. Apply one complete coat of TNEMEC 91 H_20 Hydro Zinc to all weld seams by brush or roller.

c. Final Field Coat

1. Interior Wet Surface - Apply two (2) coat of TNEMEC Series-N140-WH02 Portapox II. Tank White to 4.0 - 6.0 mils dry film thickness per coat.

2. Interior Dry Surface - Apply one (1) coat of TNEMEC Series-N140-WH02 Portapox II. Tank White to 4.0 - 6.0 mils dry film thickness per coat.

E. Exterior Coating System

a. Shop Primer

1. Apply TNEMEC Series 91 H_2O Hydro Zinc to a dry film thickness of 2.0-3.0 mils.

b. Field Stripe Coat

1. Apply one (1) complete coat of TNEMEC 91 H_2O Hydro Zinc to all weld seems by brush or roller.

c. Field Intermediate Coat

1. Apply TNEMEC Series 66 Epoxoline to a dry film thickness of 2.0-3.0 mils.

d. Field Finish Coat

1. Apply one (1) coat of TNEMEC Series 1074-COLOR Endurashield in a color selected by the engineer/owner to a dry film thickness 2.0-3.0 mils.

F. Acceptance Of Work

All surface preparation shall be approved by the engineer/owner before primer is applied. Any coating applied without engineer/owner approval of surface preparation shall be completely removed.

Request acceptance of each coat before applying next coat.

Correct work that is not acceptable and request re-inspection.

G. Lettering

After the exterior finish coat has dried, the letters "***South Woodford Water District***" shall be painted on 1 side of the tank. The coating used for the lettering must be the same coating as specified for the exterior finish coat. Letter color and orientation shall be selected by the Owner.

The letters shall be block type, approximately 24" inches high with a brush stroke of approximately 6" wide. The lettering shall be spaced as shown on the project drawings. The Contractor shall submit a layout drawing to the Engineer for approval before proceeding with the work.

3.04 DISINFECTION

After the tank has been painted and the interior surfaces have thoroughly dried, the Contractor shall remove all visible dirt and contaminating materials. The interior of the tank shall be disinfected in accordance with Chlorination Method No. 2 of AWWA C652-92. A minimum of seven (7) days following the application of the final coat on the interior surfaces shall be allowed before the tank is sterilized or filled with water.

The Contractor shall be responsible for obtaining proper disinfection as determined by bacteriological testing. The Contractor shall collect and submit samples of water from the tank and have tested by the Public Health Authority having jurisdiction.

3.05 GUARANTEE

The tank Contractor shall guarantee its work for a period of one year from the completion date defined in the contract documents to the extent that it will repair any defects caused by faulty design, workmanship or material furnished under the specifications.

Revised 1/29/03

END OF SECTION

APPENDIX A

GEOTECHNICAL REPORT

Fuller Mossbarger Scott & May
FMSM
ENGINEERS

1409
North Forbes Road
Lexington, Kentucky
40511-2050

859-422-3000
859-422-3100 FAX

www.fmsmengineers.com

April 20, 2006 O.1.1.LX2006033R01

Jeff Reynolds
HMB Professional Engineers, Inc.
3 HMB Circle
Frankfort, Kentucky 40601

Re: Report of Geotechnical Exploration
Elevated Water Storage Tank
South Woodford Water District
Woodford County, Kentucky

Dear Mr. Reynolds:

As requested, Fuller, Mossbarger, Scott and May Engineers, Inc. (FMSM) has completed the geotechnical exploration and testing at the referenced site. The work was performed in accordance with our proposal dated August 9, 2005. This report presents a general description of the site location and geology, the scope of work performed, the results of the exploration and recommendations relative to the design and construction of the foundation system for the proposed structures.

We appreciate the opportunity to provide these geotechnical engineering services. If you have any questions, please call our office.

Sincerely,

FULLER, MOSSBARGER, SCOTT AND MAY
ENGINEERS, INC.

Sharath C. Vemuri, EIT
Project Engineer

Hugo R. Aparicio
Associate

/sv/rws

Report of Geotechnical Exploration

Elevated Water Storage Tank
South Woodford Water District
Woodford County, Kentucky

Prepared for:
HMB Professional Engineers, Inc.
Frankfort, Kentucky

April 20, 2006

Report of Geotechnical Exploration
Elevated Water Storage Tank
South Woodford Water District
Woodford County, Kentucky

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Appendix

Report of Geotechnical Exploration

Elevated Water Storage Tank
South Woodford Water District
Woodford County, Kentucky

1. Introduction

South Woodford Water District of Woodford County, Kentucky plans to construct a 250,000 gallons elevated water storage tank near the community of Nonesuch, Kentucky. The project site is located off of Cummins Ferry road approximately 1.1 miles east of Nonesuch, Kentucky. The proposed developments at the project site include a 43 feet diameter water storage tank raised approximately 153 feet, measuring from the ground surface to the top of the overflow, and an access road connecting the tank site to Cummins Ferry road. An approximate location of the project site on a USGS 7.5 minute topographic quadrangle is shown in Figure 1.

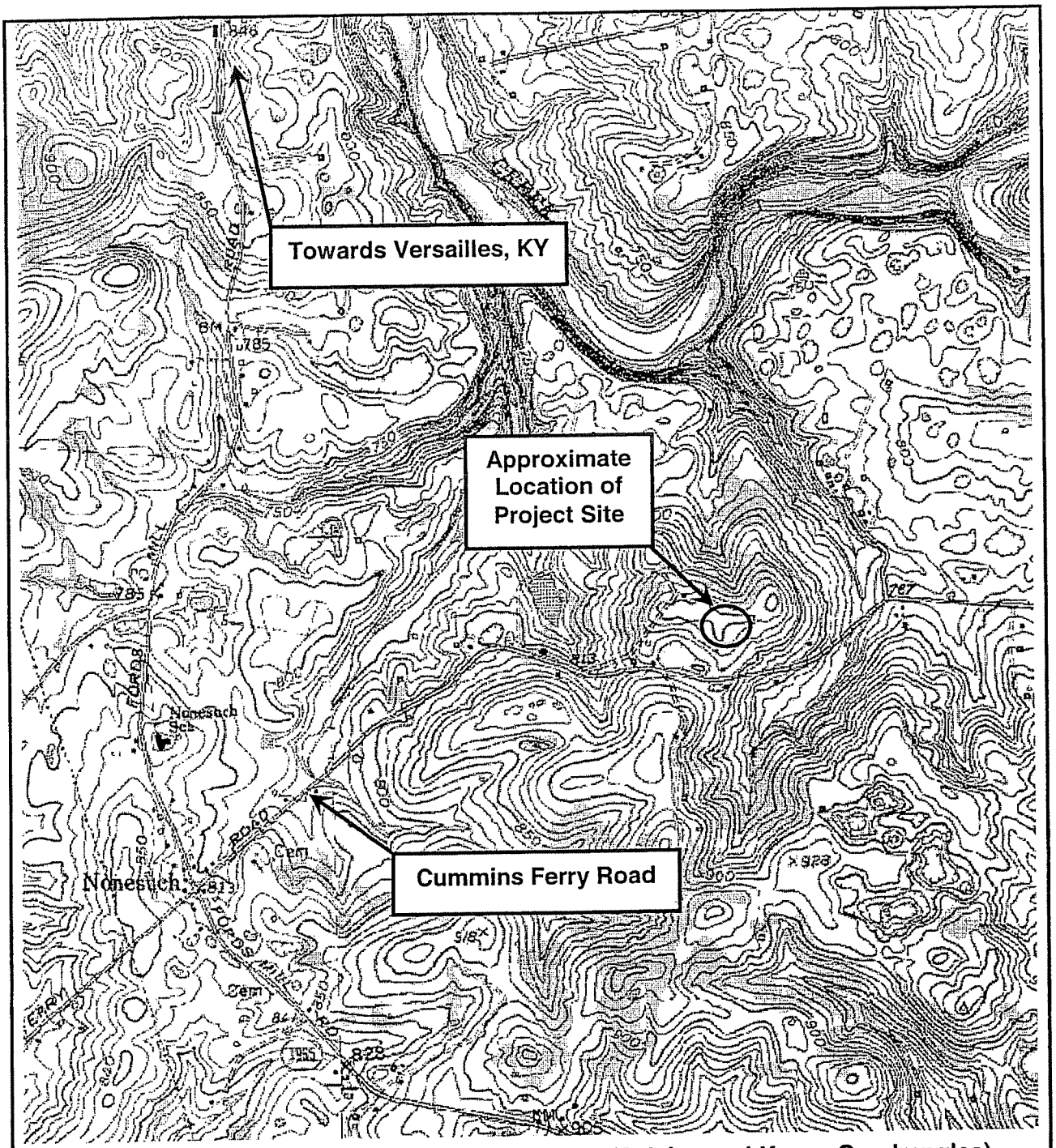
2. General Site Geology

Available geologic mapping (Geologic Map of the Keene Quadrangle, Central Kentucky, USGS, 1965) indicates the project site to be underlain by bedrock belonging to the Grier Limestone Member of Lexington Limestone Formation. The Grier Limestone Member belongs to the Middle Ordovician Series of Ordovician System and comprises of interbedded limestone (75 to 90 percent) and shale. Limestone can be described as medium gray to light gray, micro-granular, very thin to thin bedded, argillaceous and fossiliferous. Shale can be described as dark gray and fissile.

Structure contours drawn on the base of Brannon Limestone Member of Lexington Limestone Formation indicate bedrock strata dip of approximately 33 feet per mile in the west-northwest direction. Numerous faults are shown on the geologic mapping within the vicinity of the project site. The nearest fault is approximately 1.0 mile east of the project site. These faults are not known to be active, or to have been active, in the recent geologic time.

3. Scope of Work

The fieldwork for the geotechnical exploration was performed during the week of March 27, 2006. The scope of the fieldwork included advancing a total of four (4) borings at the project site, designated herein as borings B-1 through B-4. The boring locations were staked in the field based on the topographic and survey drawings supplied by HMB Professional Engineers, Inc. of Frankfort, Kentucky (HMB) and information obtained from the Owner's representative (Mr. George Weathers) prior to the subsurface exploration. The center of the tank and the boring locations were staked based on their horizontal distances from the property corners (survey pins) established in the field by HMB. The ground surface elevations of the boring locations were referenced to a temporary bench mark (TBM) located near the property corner with an elevation of 898.9 feet, as obtained from the drawings supplied by HMB. The final locations of the borings along with their coordinates are presented on the boring layout drawing included in Appendix C.



Portion of USGS 7.5 Minute Topographic Maps (Salvisa and Keene Quadrangles)

South Woodford Water District
Elevated Water Storage Tank
Woodford County, Kentucky

Figure 1. Site Location Map

Fuller Mossberger Scott & May ENGINEERS

LX2006033
April 21, 2006
Not to Scale

The subsurface exploration was performed using a truck-mounted drill rig equipped with 3¼ inch (ID) hollow stem augers following a carbide tipped tooth bit and NQ size rock coring equipment. Standard Penetration Testing (SPT) was performed in all of the borings except for boring B-4. A standard penetration test consists of dropping a 140-pound hammer to drive a split-spoon sampler 18 inches. The consistency or relative density of soil is estimated by the number of blows it takes to drive the spoon the last foot. This method is typically used to obtain soil samples, estimate the consistency or relative density of the soil and also to estimate the vertical limits of the subsurface soil horizons. Disturbed bag sample of soil horizon was also obtained from the boring locations. Two (2) of the boring locations (B-2 and B-4) were extended approximately ten (10) feet below the top of rock. After completion of the drilling and sampling procedures, the boreholes were checked for the presence of subsurface water and backfilled with auger cuttings.

A geotechnical engineer was present on-site throughout the drilling and sampling operations. The engineer directed the drill crew, logged the subsurface materials encountered during the exploration and collected soil and rock samples. Particular attention was given to the soil's color, texture, moisture content and consistency or relative density. The rock core samples were reviewed to evaluate the bedrock's lithology and load bearing properties. The soil and rock core samples extracted from the borings were transported to our laboratory and will be available for review by interested parties for a period of one month following the issuance of this report, at which time they will be discarded unless instructed otherwise.

The SPT samples were subjected to natural moisture content determination in accordance with ASTM D 2216. The composite bag sample was subjected to standard Proctor moisture density test in accordance with ASTM D 698. The results of the laboratory testing are presented in Appendix B and briefly summarized in Section 4.2, except for the natural moisture content test results which are presented on the boring logs in Appendix A and in Table 2.

4. Results of the Subsurface Exploration

4.1. Summary of Borings

The boring layout drawing is presented in Appendix C. Typed boring logs are presented in Appendix A and a summary of boring information is presented in Table 1, where all measurements are expressed in feet.

Table 1. Summary of Borings

Boring No.	Surface Elevation	Top of Rock [1]		Length of Core	Bottom of Hole	
		Depth	Elevation		Depth	Elevation
B-1	900.1	3.1	897.0	--	4.0	896.1
B-2	899.6	2.5	897.1	10.0	13.5	886.1
B-3	898.6	2.3	896.3	--	2.4	896.2
B-4	900.1	2.4	897.7	10.3	12.9	887.2

[1] -Top of rock indicates the beginning or rock-like resistance to the advancement of augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.

4.2. Subsurface Soil Conditions

The subsurface soil conditions encountered at the boring locations indicate the project site to be underlain by residual clay with a thin a layer of top soil cover (0.5 feet thick). The residual clay encountered in different borings can be visually described as lean to fat clay, brown to reddish brown, moist, medium stiff to stiff, with chert fragments and some thin roots.

The results of standard penetration testing performed in different borings are presented on the boring logs in Appendix A and summarized in Table 2 along with the natural moisture content of two SPT samples, as determined during the laboratory testing.

Table 2. Results of Standard Penetration Testing

Boring No.	Depth (feet)		Elevation Interval (feet)		Hammer Blows Per 6-inch Penetration	Blow Count (N- Value)	Moisture Content (%)
	from	to	from	to			
B-1	1.5	3.0	898.6	897.1	3-5-6	11	28
B-2	2.5	2.7	897.1	896.9	50+	100+	--[1]
B-3	1.0	2.5	897.6	896.1	3-5-17	22	26

[1] – No soil sample was retrieved from the split barrel sampler.

The results of standard Proctor moisture density testing are presented in Appendix B and briefly summarized in Table 3.

Table 3. Results of Standard Proctor Moisture Density Testing

Parameter	Value
Optimum Moisture Content (w)	23.7%
Maximum Dry Density (γ_{max})	96.4 pound per cubic foot

4.3. Bedrock Conditions

The subsurface information obtained from the boring locations indicate very shallow bedrock conditions at the project site. The depths to the top of bedrock were approximately 2.5 feet to 3.0 feet with the top of rock elevations ranging from 897.7 feet at B-4 to 896.3 feet at B-3. The bedrock obtained from the boring locations (B-2 and B-4) consisted of limestone (90 percent) interbedded with thin layers of shale. Limestone can be described as gray to light gray, fine to very fine crystalline grained, hard to very hard, thin to thick bedded, argillaceous, fossiliferous and with gradational streaks of shale. Some of the limestone beds are separated by thin clay seams (less than 0.2 feet thick) in the upper three to five feet of the bedrock. The bedding planes in this zone are also water stained. Shale can be described as dark gray, moderately hard and fissile. The rock quality designation (RQD) values were low within the upper half of the cored portion of bedrock and gradually improved with depth. The RQD values ranged from 0 percent to 76 percent and the rock core recovery values ranged from 0 percent to 100 percent.

4.4. Subsurface Water Conditions

No subsurface water was encountered in any of the boring locations drilled at the project site. Note, however, that seasonal fluctuations, precipitation events, and other factors may impact subsurface water conditions.

5. Conclusions and Recommendations

5.1. General

It is our understanding that the proposed development includes a 43-feet diameter elevated water storage tank with a capacity of 250,000 gallons. The conclusions and recommendations that follow are based on the layout of the structures provided by HMB prior to the subsurface exploration and the results of the subsurface exploration. If changes are made to the above stated location or dimensions of the tank, FMSM should be notified so that appropriate adjustments can be made to the conclusions and recommendations contained herein.

5.2. Subsurface Conditions

The subsurface conditions encountered at the project site indicate very shallow bedrock conditions with residual clay overburden. The residual clay can be visually classified as lean to fat clay, brown to reddish brown, moist and medium stiff to stiff. The underlying bedrock comprised of limestone (90 percent) interbedded with thin layers of shale. Limestone can be described as gray to light gray, fine to very fine crystalline grained, hard to very hard, thin to thick bedded and shale can be described as dark gray, soft to moderately hard and fissile. The limestone bedrock contains thin clay seams and water stained bedding planes within the upper 3 to 5 feet of the bedrock.

5.3. Foundation System Recommendation

Based on the subsurface information obtained from the project site and the proposed type of structure, it is recommended that the proposed elevated water storage tank be supported on sound limestone bedrock through a system of direct bearing (shallow) footings. Recommendations relative to a rock bearing foundation system and other general site work recommendations are presented in the following sections.

5.4. Recommendations for Rock Bearing Foundation System

5.4.1. Observing the recommendations listed herein, the recommended net allowable bearing value for foundation elements placed directly on competent limestone bedrock is **forty thousand (40,000) pounds per square foot (psf).**

5.4.2. The review of core samples obtained from the boring locations indicated the presence of soft clay seams down to approximately 3.0 to 5.0 feet below the top of the bedrock. Based on this information, it is recommended that the foundation elements be placed, in general, a minimum of 12 inches below the top of the limestone bedrock. However, the actual bearing elevation of the foundation elements should be determined during construction by drilling a minimum of one 1.5-inch diameter percussion test hole at any proposed spread footing location. The percussion test hole should be drilled to a depth of five (5) feet or twice the width of the foundation element, which ever is greater, below the proposed bearing elevation

in order to verify the integrity of the underlying bedrock and to identify any weathered zones, clay seams or voids that may affect the foundation support. Each hole should be inspected by a qualified engineering technician using a "hooked" probe to ensure that sufficient sound bedrock, free of voids and compressible (clay) zones is present directly beneath the foundation elements. If the percussion drill holes reveal voids or clay seams below the surface, embedment of foundation elements will have to extend below these features until sound rock is encountered. Any zones of questionable bearing capacity encountered in these test holes should be evaluated by a qualified professional engineer and the proposed bearing elevations adjusted accordingly.

5.4.3. Rock bearing foundations should be constructed on a level bedrock surface. Where a sloping rock surface is encountered, the foundations should be stair-stepped as necessary to provide such a level surface.

5.5. General Foundation Recommendations

5.5.1. The minimum recommended plan dimensions for isolated spread footings (columns) is 24 inches by 24 inches, however, actual footing sizes should be determined by a structural engineer based on the design structural loads and on the net allowable bearing values presented in Section 5.4.

5.5.2. Reinforcing steel should be placed in all foundation elements to provide rigidity and strength to bridge over any zones of weakness which might develop in the foundation materials. Prior to reinforcing steel and concrete placement, the bottom of all footing excavations should be free of loose rock, soil, organic matter, construction debris and other compressible materials. The bottom of the footing excavation should be inspected by a qualified engineering technician working under the direct supervision of a professional engineer experienced in geotechnical engineering.

5.5.3. The excavated footing trenches should not be left open to allow the accumulation of water. During construction, the contractor should ensure that water does not accumulate within the foundation trenches or caisson shafts, as water tends to soften and weaken the foundation bedrock or soil. If this cannot be done, the last four to six inches of foundation material should be left in place until preparations for placing concrete are completed. In no case should concrete be placed over frozen bearing surfaces or in areas of standing water.

5.6. General Site Work Recommendations

5.6.1. Areas to receive fill should be stripped of all surface layer vegetation, top soil and organic material prior to any fill placement. The actual stripping required to remove the top soil and other unsuitable materials will vary and must be verified in the field during construction. An estimated depth of stripping may be inferred by the designer from a review of the boring logs. Once stripping is complete, the subsurface should be proof-rolled in the presence of a qualified soils engineering technician and brought to design subgrade elevation with approved fill material compacted in accordance with Item 5.6.2.

5.6.2. All fill material placed at the site must be properly evaluated, placed and compacted to obtain satisfactory results. Suitable fill shall consist of soil types as described in Item 5.6.4 that are free of topsoil, organic material and rocks larger than three inches in any dimension. The selected fill material should be placed in maximum eight-inch lifts (loose thickness) and each lift compacted properly. The in-place density should be monitored using field density

gauges. Any fill to be compacted with hand compactors or other manual means should be placed in maximum four-inch lifts. All fill placements should be performed in the presence of a qualified technician experienced in the monitoring of earthwork operations. The technician should be working under the direct supervision of a professional engineer experienced in geotechnical engineering.

5.6.3. Site grading should be maintained during and after construction so that positive drainage is promoted at all times. This practice will serve to minimize the effects of moisture content fluctuation on the finished structure.

5.6.4. Fill requirements may result in obtaining off-site borrow materials. Suitable fill materials consist of native soils free of vegetation, topsoil, organics, wet soil, construction debris and rock fragments greater than three inches in any dimension. It is preferred that fill materials consist of CH, CL, SC or GC type soils. Engineering classification and standard Proctor tests should be performed on all potential fill materials, and the test results evaluated by a geotechnical engineer to determine suitability.

5.6.5. Waste material generated from rock and soil removal should be hauled off-site for proper disposal. Excavated material should not be left on the slopes below or adjacent to the structures, as this could result in long-term stability and erosion problems.

5.6.6. All excavations should be performed in accordance with applicable federal, state and local guidelines and regulations including OSHA construction standards for excavations. Design of excavations and relative protective bracing systems is the sole responsibility of the contractor. It is recommended that no soil excavation without proper bracing and support be allowed at the site.

5.6.7. If construction of the project is undertaken during periods of inclement weather, the contractor should be prepared for additional work such as: (1) removal or scarification and recompaction of water softened materials in areas to receive fill or pavements; (2) construction delays due to rain, snow, and overall wet project conditions; (3) use of crushed stone, geo-grid or geotextile fabric to stabilize soft ground areas, and (4) additional efforts to aerate wet soils to proper moisture content prior to compaction. Efforts should be made to schedule project construction during drier months, if possible.

5.6.8. Based on the subsurface conditions encountered at the project sites and in accordance with Table 1615.1.1 of the 2002 Edition of the Kentucky Building Code, the recommended site classification for project site is B.

6. Closure

The scope of FMSM's services did not include an environmental assessment or investigation for the presence or absence of wetlands and hazardous or toxic materials in the soil, surface water, groundwater or air, on, below or around the site. Any statements in this report or on the boring logs regarding odors noted or unusual or suspicious items or conditions observed are strictly for the information of the client. The boring log and related information presented in this report depict approximate subsurface conditions only at the specific boring location noted and at the time of drilling. Conditions at other locations may differ from those occurring at the boring location. Also, the passage of time may result in a change in the subsurface conditions at the boring locations. The conclusions and recommendations presented herein

are based on information gathered from the boring advanced during this investigation using that degree of care and skill ordinarily exercised under similar circumstances by competent members of the engineering profession. No warranties can be made regarding the continuity of conditions beyond the boring locations.

Appendix A

Boring Logs

Fuller Mossbarger Scott & May ENGINEERS

SUBSURFACE LOG

Project Number LX2006033
Project Name South Woodford Water Tank
County Woodford, Kentucky
Project Type Geotechnical Exploration
Supervisor S. Vemuri Driller James Felts
Logged By Sharath Vemuri

Location Nonesuch, Kentucky
Boring No. B-1 Total Depth 4.0'
Surface Elevation 900.1'
Date Started 3-27-06 Completed 3-27-06
Depth to Water -- Date/Time 3-27-06
Depth to Water -- Date/Time --

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows/6-Inch / Rec. %	Moist. % / SDI	Remarks
900.1'	0.0'	Top of Hole							
899.6'	0.5'	Top Soil							
		Lean to fat clay, brown to reddish brown, moist, medium stiff to stiff, with chert fragments and intermittent thin to very thin roots.		SPT-1	1.5'-3.0'	1.0'	3-5-6	28	
897.0'	3.1'	Top of rock*							
		Bedrock (Augered)							
896.1'	4.0'	Auger Refusal							
		Bottom of hole							

*-Top of rock indicates the beginning or rock-like resistance to the advancement of augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.

Fuller Mossbarger Scott & May ENGINEERS

SUBSURFACE LOG

Project Number LX2006033
Project Name South Woodford Water Tank
County Woodford, Kentucky
Project Type Geotechnical Exploration
Supervisor S. Vemuri Driller James Felts
Logged By Sharath Vemuri

Location Nonesuch, Kentucky
Boring No. B-2 Total Depth 13.5'
Surface Elevation 899.6'
Date Started 3-27-06 Completed 3-27-06
Depth to Water -- Date/Time 3-27-06
Depth to Water -- Date/Time --

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows/6-Inch / Rec. %	Moist. % / SDI	Remarks
899.6'	0.0'	Top of Hole							
899.1'	0.5'	Top Soil							
		Lean to fat clay, brown to reddish brown, moist, medium stiff to stiff, with chert fragments and intermittent thin to very thin roots.		SPT-1	2.5'-2.7'	0.0	50+	--	
897.1'	2.5'	Top of rock							
		Bedrock (Augered)							
896.1'	3.5'	Begin coring							
		Limestone (90%) interbedded with shale. Limestone is gray to light gray, fine to very fine crystalline grained, hard to very hard, thin to thick bedded, argillaceous, fossiliferous and with gradational streaks of shale. Shale is dark gray, moderately hard and fissile. -water stained bedding planes and thin (less than0.2 feet thick) clay seams between 896.1' and 892.3'.		56%	10.0'	9.8'	98%		
886.1'	13.5'								
		Bottom of hole							

Fuller Mossberger Scott & May ENGINEERS

SUBSURFACE LOG

Project Number LX2006033
Project Name South Woodford Water Tank
County Woodford, Kentucky
Project Type Geotechnical Exploration
Supervisor S. Vemuri Driller James Felts
Logged By Sharath Vemuri

Location Nonesuch, Kentucky
Boring No. B-3 Total Depth 2.4'
Surface Elevation 898.6'
Date Started 3-27-06 Completed 3-27-06
Depth to Water -- Date/Time 3-27-06
Depth to Water -- Date/Time --

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows/6-Inch / Rec. %	Moist. % / SDI	Remarks
898.6'	0.0'	Top of Hole							
898.2'	0.4'	Top Soil							
		Lean to fat clay, brown to reddish brown, moist, medium stiff to stiff, with chert fragments and intermittent thin to very thin roots.		SPT-1	1.0'-2.5'	1.0'	3-5-17	26	
896.3'	2.3'	Top of rock*							
		Bedrock (Augered)							
896.2'	2.4'	Auger Refusal							
		Bottom of hole							

*-Top of rock indicates the beginning or rock-like resistance to the advancement of augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.

Fuller Mossbarger Scott & May ENGINEERS

SUBSURFACE LOG

Project Number	LX2006033	Location	Nonesuch, Kentucky
Project Name	South Woodford Water Tank	Boring No.	B-4
County	Woodford, Kentucky	Total Depth	12.9'
Project Type	Geotechnical Exploration	Surface Elevation	900.1'
Supervisor	S. Vemuri	Date Started	3-27-06
Driller	James Felts	Completed	3-27-06
Logged By	Sharath Vemuri	Depth to Water	--
		Date/Time	3-27-06
		Depth to Water	--
		Date/Time	--

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows/6-Inch / Rec. %	Moist. % / SDI	Remarks
900.1'	0.0'	Top of Hole							
899.6'	0.5'	Top Soil							
		Lean to fat clay, brown to reddish brown, moist, medium stiff to stiff, with chert fragments and intermittent thin to very thin roots.		SPT-1	2.5'-2.7'	0.0	50+		
897.7'	2.4'	Top of rock							
		Bedrock (Augered)							
897.5'	2.6'	Begin coring							
	5.4'	Limestone (90%) interbedded with shale. Limestone is gray to light gray,		0	2.8'	2.2'	79%		
	10.4'	fine to very fine crystalline grained, hard to very hard, thin to thick bedded, argillaceous, fossiliferous and with gradational streaks of shale. Shale is dark gray, moderately hard and fissile.		72%	5.0'	5.0'	100%		
887.2'	12.9'	-water stained bedding planes and thin (less than 0.2 feet thick) clay seams between 897.5' and 894.3'.		76%	2.5'	2.5'	100%		
		Bottom of hole							

Appendix B

Results of Laboratory Testing

Fuller Mossberger Scott & May

ENGINEERS

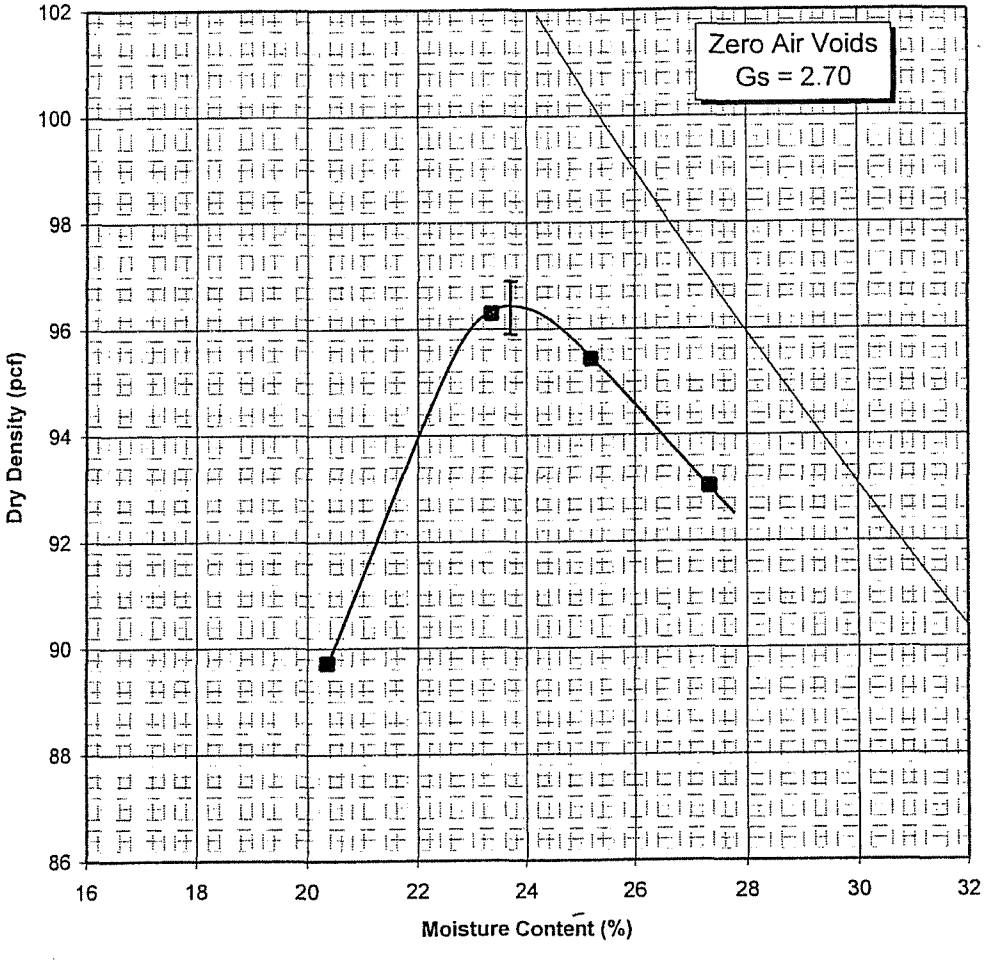
Moisture-Density Data Sheet

Project: South Woodford Water Tank
Source: B-1, B-2, B-3 & B-4, 0.5'-2.5'
Sample Description: Lean clay (CL), brown
Visual Notes:
Prepared: Moist Oversized Fraction: < 5 % Rammer: Manual

Project No.: LX2006033
Sample No.: 3

Test Method: ASTM D 698 - Method B
Gs - Fines: Assumed

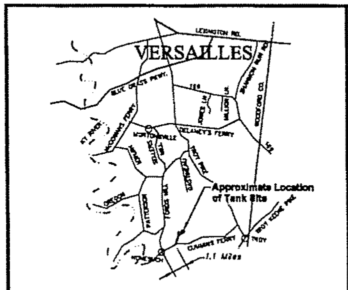
Mold Weight 4340.8 grams		Moisture Determination				
Wet Weight plus Mold (grams)	Wet Weight minus Mold (grams)	Wet Soil and Can Weight (grams)	Dry Soil and Can Weight (grams)	Can Weight (grams)	Water Content (%)	Dry Density (pcf)
5967	1626	545.31	465.48	73.26	20.4	89.7
6130	1789	546.53	457.16	74.46	23.4	96.3
6140	1799	632.56	520.22	74.51	25.2	95.4
6125	1784	521.05	425.19	74.74	27.4	93.0



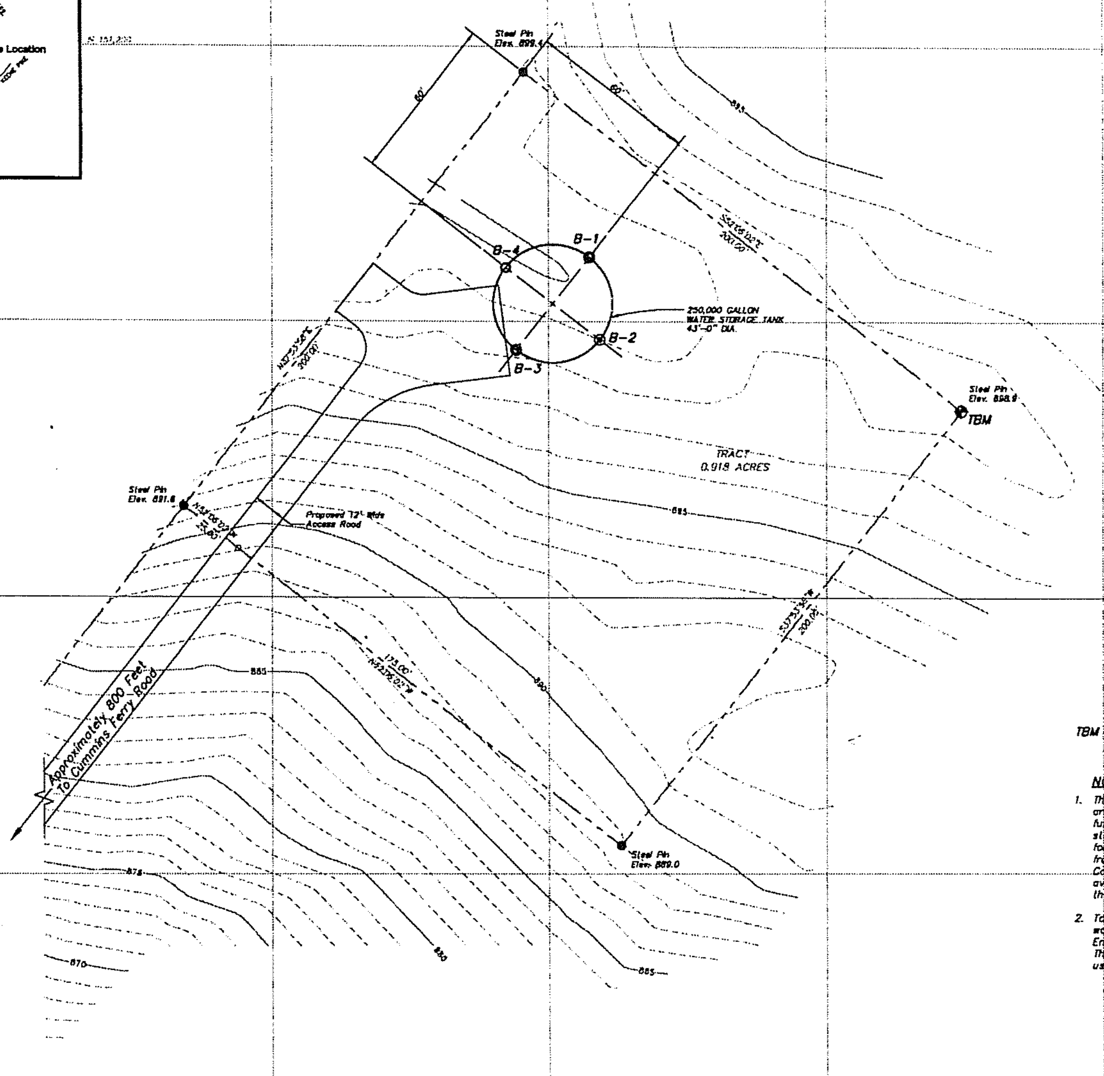
Maximum Dry Density 96.4 PCF
Optimum Moisture Content 23.7 %

Appendix C

Boring Layout



VICINITY MAP
NOT TO SCALE



BORING LAYOUT
SCALE: 1" = 20'

BORING LOCATION TABLE			
Boring No.	Northing	Easting	Elevation (Feet)
B-1	151,124	1,500,315	900.1
B-2	151,093	1,500,318	899.6
B-3	151,089	1,500,288	898.8
B-4	151,119	1,500,284	900.1

LEGEND:

- Soil Boring with Standard Penetration Test
- Soil Boring with Standard Penetration Test and Rock Core
- Soil Boring with Rock Core
- TBM Temporary Bench Mark – Steel Pin Elev. 898.9 feet

NOTES:

1. The geotechnical information and data furnished herein are not intended as representation or warranties but are furnished for information only. It shall be distinctly understood that the Owner or Engineer will not be responsible for any deduction, interpretation or conclusion drawn therefrom. The information is made available in order that the Contractor may have ready access to the same information available to the Owner and the Engineer and is not part of this contract.
2. Topographic and survey information for the boring layout was taken from a survey drawing supplied by HMB Professional Engineers, Inc. at 3 HMB Circle, Frankfort, Kentucky 40601. The information is believed to be correct, but is not to be used by the Contractor for construction of the project.

GRAPHIC SCALE: 1" = 20'
CONTOUR INTERVAL = 1'

Fuller Mossbarger Scott & May
FMSM ENGINEERS
LEXINGTON • LOUISVILLE • CINCINNATI • COLUMBUS • ST. LOUIS • JEFFERSONVILLE

GEOTECHNICAL EXPLORATION

PROPOSED ELEVATED WATER STORAGE TANK
SOUTH WOODFORD WATER DISTRICT
WOODFORD COUNTY, KENTUCKY

PROJECT NO.	LX2006033
DATE	APRIL 2006
DRAWN BY	CDV
CHECKED BY	SCV
CHECKED BY	HRA
SCALE	1" = 20'

SHEET **1 OF 1**

INSTRUCTIONS

To insure timely achievement of the grant objectives the owner (grantee) must provide EPA with a grants activities schedule, contract construction schedules and corresponding payment outlay schedules for the grant and each contract under the grant. One copy of information similar to that showing the Construction and Outlay Schedule Form will be submitted for the grant schedule with the grant acceptance. A separate form will accompany each contract at time of contract award.

A. The grant activities schedule shall depict the period from grant award through grant closeout and cover all major milestone date. The grant activities schedule shall include Schedule I information items as well as other appropriate items necessary to monitor the grant. Schedule II shall be filled out to estimate the cumulative (all construction and architectural/engineering contracts) payment schedule to be requested by the grantee from EPA during the grant period, and whenever actual outlays vary beyond -5% and +10% from the schedule.

B. Individual contractor's construction schedules for each contract will be submitted to support the grant activities schedule. The Schedule I shall be submitted prior to date of advertisement of each contract and Schedule II along with the contractor's construction schedule shall be submitted seven (7) calendar days prior to the dates of the pre-construction conference. The contractor's construction schedule shall depict the contractor's plan for completing all contract requirements and show work placement in dollars versus contract time. Schedule II shall depict the contract payment outlay by month or quarter. The contract schedule will be coordinated with all parties at the pre-construction conference.

The grants activities schedule, contractor construction schedules, will be the basis for monitoring progress towards completion of the project. The schedules shall be maintained at the available for inspection and updated at least monthly. The schedules shall be revised to incorporate approved change orders as they occur.

All of the schedules will be submitted to the State Division of Water.

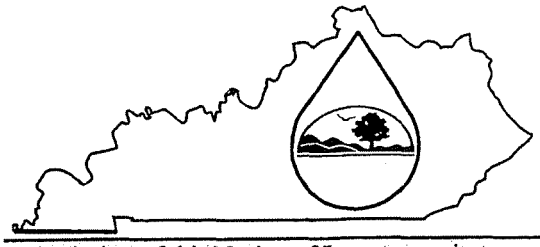
Attachment No. 16

NOTICE OF INTENT

All construction projects with surface disturbance of more than 1 acre during the period of construction must have a KPDES Storm Water General Permit. The contractor must complete and submit the attached form at least 48 hours prior to start of construction to the address below:

Section Supervisor
Inventory and Data Management Section
KPDES Branch
Kentucky Division of Water
14 Reilly Road, Frankfort Office Park
Frankfort, Kentucky 40601

KPDES FORM NOI-SW



Kentucky Pollutant Discharge Elimination System (KPDES)
Notice of Intent (NOI)
for Storm Water Discharges
Associated with Industrial Activity Under the KPDES General Permit

Submission of this Notice of Intent constitutes notice that the party identified in Section I of this form intends to be authorized by a KPDES permit issued for storm water discharges associated with industrial activity. Becoming a permittee obligates such discharger to comply with the terms and conditions of the permit.
ALL NECESSARY INFORMATION MUST BE PROVIDED ON THIS FORM (See Instructions on back)

I. Facility Operator Information

Name:		Phone:	
Address:		Status of Owner/Operator:	
City, State, Zip Code:			

II. Facility/Site Location Information

Name:			
Address:			
City, State, Zip Code:			
County:			
Site Latitude: (degrees/minutes/seconds)		Site Longitude: (degrees/minutes/seconds)	

III. Site Activity Information

MS4 Operator Name:							
Receiving Water Body:							
Are there existing quantitative data?	Yes ☐ If Yes, submit with this form. No ☐						
SIC or Designated Activity Code Primary		2nd		3rd		4th	
If this facility is a member of a Group Application, enter Group Application Number:							
If you have other existing KPDES Permits, enter Permit Numbers:							

IV. Additional Information Required FOR CONSTRUCTION ACTIVITIES ONLY

Project Start Date:		Completion Date:	
Estimated Area to be disturbed (in acres):			
Is the Storm Water Pollution Prevention Plan in Compliance with State and/or Local Sediment and Erosion Plans?	Yes ☐ No ☐		

Certification: I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Printed or Typed Name:			
Signature:		Date:	

Kentucky Pollutant Discharge Elimination System (KPDES)
Instructions
Notice of Intent (NOI) for Storm Water Discharges Associated with Industrial Activity
To Be Covered Under The KPDES General Permit

WHO MUST FILE A NOTICE OF INTENT (NOI) FORM

Federal law at 40 CFR Part 122 prohibits point source discharges of stormwater associated with industrial activity to a water body of the Commonwealth of Kentucky without a Kentucky Pollutant Discharge Elimination System (KPDES) permit. The operator of an industrial activity that has such a storm water discharge must submit a NOI to obtain coverage under the KPDES Storm Water General Permit. If you have questions about whether you need a permit under the KPDES Storm Water program, or if you need information as to whether a particular program is administered by the state agency, call the Storm Water Contact, Industrial Section, Kentucky Division of Water at (502) 564-3410.

WHERE TO FILE NOI FORM

NOIs must be sent to the following address:

Section Supervisor
Inventory & Data Management Section
KPDES Branch, Division of Water
Frankfort Office Park
14 Reilly Road
Frankfort, KY 40601

COMPLETING THE FORM

Type or print legibly in the appropriate areas only. If you have any questions regarding the completion of this form call the Storm Water Contact, Industrial Section, at (502) 564-3410.

SECTION I - FACILITY OPERATOR INFORMATION

Give the legal name of the person, firm, public organization, or any other entity that operates the facility or site described in this application. The name of the operator may or may not be the same as the name of the facility. The responsible party is the legal entity that controls the facility's operation, rather than the plant or site manager. Do not use a colloquial name. Enter the complete address and telephone number of the operator.

Enter the appropriate letter to indicate the legal status of the operator of the facility.

F = Federal	M = Public (other than federal or state)
S = State	P = Private

SECTION II - FACILITY/SITE LOCATION INFORMATION

Enter the facility's or site's official or legal name and complete street address, including city, state, and ZIP code.

SECTION III - SITE ACTIVITY INFORMATION

If the storm water discharges to a municipal separate storm sewer system (MS4), enter the name of the operator of the MS4 (e.g., municipality name, county name) and the receiving water of the discharge from the MS4. (A MS4 is defined as a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains) that is owned or operated by a state, city, town, borough, county, parish, district, association, or other public body which is designed or used for collecting or conveying storm water.)

If the facility discharges storm water directly to receiving water(s), enter the name of the receiving water.

Indicate whether or not the owner or operator of the facility has existing quantitative data that represent the characteristics and concentration of pollutants in storm water
discharges.

If data is available submit with this form.

List, in descending order of significance, up to four 4-digit standard industrial classification (SIC) codes that best describe the principal products or services provided at the facility or site identified in Section II of this application.

If the facility listed in Section II has participated in Part 1 of an approved storm water group application and a group number has been assigned, enter the group application number in the space provided.

If there are other KPDES permits presently issued for the facility or site listed in Section II, list the permit numbers.

SECTION IV - ADDITIONAL INFORMATION REQUIRED FOR CONSTRUCTION ACTIVITIES ONLY
Construction activities must complete Section IV in addition of Sections I through III. Only construction activities need to complete Section IV.

Enter the project start date and the estimated completion date for the entire development plan.

Provide an estimate of the total number of acres of the site on which soil will be disturbed (round to the nearest acre).

Indicate whether the storm water pollution prevention plan for the site is in compliance with approved state and/or local sediment and erosion plans, permits, or storm water management plans.

SECTION V - CERTIFICATION
Federal statutes provide for severe penalties for submitting false information on this application form. Federal regulations require this application to be signed as follows:

For a corporation: by a responsible corporate officer, which means: (i) president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision making functions, or (ii) the manager of one or more manufacturing, production, or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding $25 million (in second-quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures;

For a partnership or sole proprietorship: by a general partner or the proprietor; or

For a municipality, state, Federal, or other public facility: by either a principal executive officer or ranking elected official.

WAGE RATES

Federal Davis-Bacon rates are not applicable for these funds. This determination applies only to the grant/loan portion of this project. Please contact the other funding sources, if applicable, for their requirements pertaining to federal wage rates. You must contact the Kentucky Labor Cabinet for determination of applicable state wages.

STATE WAGE RATES

Ernie Fletcher
Governor

ENVIRONMENTAL AND PUBLIC PROTECTION CABINET
DEPARTMENT OF LABOR
OFFICE OF WORKPLACE STANDARDS
1047 US Hwy 127 S STE 4
Frankfort, Kentucky 40601
Phone: (502) 564-3070
www.labor.ky.gov

Teresa J. Hill
Secretary

Philip J. Anderson
Commissioner

Christopher H. Smith
Executive Director

October 31, 2006

Jeff Reynolds
HMB Engineers
3 HMB Circle
Frankfort KY 40601

Re: South Woodford Water District, Phase IV Water Project
120-H-00041-05-2, Heavy/Highway

Advertising Date as Shown on Notification: November 1, 2006

Dear Jeff Reynolds:

This office is in receipt of your written notification on the above project as required by KRS 337.510 (1).

I am enclosing a copy of the current prevailing wage determination number CR-2-007, dated May 18, 2005 for WOODFORD County. This schedule of wages shall be attached to and made a part of the specifications for the work, printed on the bidding blanks, and made a part of the contract for the construction of the public works between the public authority and the successful bidder or bidders.

The determination number assigned to this project is based upon the advertising date contained in your notification. There may be modifications to this wage determination prior to the advertising date indicated. In addition, if the contract is not awarded within 90 days of this advertising date or if the advertising date is modified, a different set of prevailing rates of wages may be applicable. It will be the responsibility of the public authority to contact this office and verify the correct schedule of the prevailing rates of wages for use on the project. Your project number is as follows:
120-H-00041-05-2, Heavy/Highway

Sincerely,

LR-2

Jan Peters-Haynes
Prevailing Wage Specialist

KENTUCKY DEPARTMENT OF LABOR
PREVAILING WAGE DETERMINATION
CURRENT REVISION
LOCALITY NO. 007

Determination No. CR-2-007

Date of Determination: May 18, 2005

Project No.
120-H-00041-05-2, Heavy/Highway

This schedule of the prevailing rate of wages for Locality No. 007, which includes Anderson, Franklin & Woodford Counties, has been determined in accordance with the provisions of KRS 337.505 to 337.550. This determination shall be referred to as Prevailing Wage Determination No. CR-2-007.

Apprentices shall be permitted to work as such subject to Administrative Regulations adopted by the Executive Director of Workplace Standards. Copies of these regulations will be furnished upon request to any interested person.

Overtime is to be computed at not less than one and one-half (1 1/2) times the indicated BASE RATE for all hours worked in excess of eight (8) per day, and/or in excess of forty (40) per week. However, KRS 337.540 permits an employee and employer to agree, in writing, that the employee will be compensated at a straight time base rate for hours worked in excess of eight (8) hours in any one calendar day, but not more than ten (10) hours worked in any one calendar day, if such written agreement is prior to the over eight (8) hours in a calendar day actually being worked, or where provided for in a collective bargaining agreement. The fringe benefit rate is to be paid for each hour worked at a straight time rate for all hours worked. Fringe benefit amounts are applicable for all hours worked except when otherwise noted. Welders will receive rate for craft in which welding is incidental.

No laborer, workman or mechanic shall be paid at a rate less than that of the General Laborer except those classified as bona fide apprentices registered with the Kentucky State Apprenticeship Supervisor unless otherwise specified in this schedule of wage rates.

NOTE: The type of construction shall be determined by applying the following definitions.

BUILDING CONSTRUCTION

Building construction is the construction of sheltered enclosures with walk-in access for the purpose of housing persons, machinery, equipment, or supplies. It includes all construction of such structures, the installation of utilities and the installation of equipment, both above and below grade level, as well as incidental grading, utilities and paving.

CR-2-007
May 18, 2005

HIGHWAY CONSTRUCTION

Highway construction includes the construction, alteration or repair of roads, streets, highways, runways, taxiways, alleys, trails, paths, parking areas, and other similar projects not incidental to building or heavy construction. It includes all incidental construction in conjunction with the highway construction project.

HEAVY CONSTRUCTION

Heavy projects are those projects that are not properly classified as either "building" or "highway". For example, dredging projects, water and sewer line projects, dams, flood control projects, sewage treatment plants and facilities, and water treatment plants and facilities are considered heavy.

Philip J. Anderson, Commissioner
Kentucky Department of Labor

Christopher H. Smith, Executive Director
Office of Workplace Standards
Kentucky Department of Labor

Ratified September 28, 2005

CR-2-007
May 18, 2005

CLASSIFICATIONS		RATE AND FRINGE BENEFITS	
ASBESTOS/INSULATION WORKERS:		BASE RATE FRINGE BENEFITS	$16.00 2.00
BOILERMAKERS:		BASE RATE FRINGE BENEFITS	$24.65 12.94
BRICKLAYERS:			
Bricklayers:		BASE RATE FRINGE BENEFITS	$20.43 5.33
Layout & Sawmen:		BASE RATE FRINGE BENEFITS	$20.68 5.33
Refractory/Acid/Glass:		BASE RATE FRINGE BENEFITS	$20.93 5.33
CARPENTERS:			
Carpenters:	BUILDING	BASE RATE FRINGE BENEFITS	$16.63 6.08
Piledrivermen	BUILDING	BASE RATE FRINGE BENEFITS	$17.13 6.08
Carpenters:	HEAVY & HIGHWAY	BASE RATE FRINGE BENEFITS	$20.70 5.68
Pildrivermen:	HEAVY & HIGHWAY	BASE RATE FRINGE BENEFITS	$20.95 5.68
Divers:	HEAVY & HIGHWAY	BASE RATE FRINGE BENEFITS	$31.43 5.68

CR-2-007
May 18, 2005

CLASSIFICATIONS	RATE AND FRINGE BENEFITS	
CEMENT MASONS:	BASE RATE	$ 17.50
	FRINGE BENEFITS	4.95
ELECTRICIANS:	BASE RATE	$25.75
	FRINGE BENEFITS	9.52

***When electricians are required to work from Bosun chairs, trusses, stacks, tanks, scaffolds, catwalks, radio and TV towers, structural steel-open, unprotected, unfloored raw steel, bridges, or similar hazardous locations where workman are subject to a direct fall (except for work performed using JLG's and bucket trucks up to 75 ft.): 50' to 75' - add 25% above workman's straight time rate; over 75' - add 50% above workman's straight time rate.**

ELEVATOR CONSTRUCTORS:	BASE RATE	$27.40
	FRINGE BENEFITS	9.60

ANDERSON COUNTY:

GLAZIERS:	BASE RATE	$10.00

FRANKLIN COUNTY:

GLAZIERS:	BASE RATE	$18.01
	FRINGE BENEFITS	3.88

WOODFORD COUNTY:

GLAZIERS:	BASE RATE	$15.45
IRONWORKERS:	BASE RATE	$23.16
	FRINGE BENEFITS	13.00

CR-2-007
May 18, 2005

CLASSIFICATIONS RATE AND FRINGE BENEFITS

LABORERS:

BUILDING GROUP 1:
General laborers, asbestos abatement laborer, toxic waste removal laborer, water boys, tool room checker, carpenter tenders, (civil engineer helper, rodman, grade checkers excluding all field work performed by engineering firms), concrete pouring and curing, concrete form stripping and wrecking, hand digging and backfilling of ditches, clearing of right of ways and building sites, wood sheeting and shoring, signalman for concrete bucket and general cleaning, and environmental laborer - nuclear, radiation, toxic and hazardous waste - Level D:

BUILDING	*BASE RATE	$13.73
	FRINGE BENEFITS	5.32

BUILDING GROUP 2:
All air tool operators, air track drills, asphalt rakers, tampers, batchers plant and scale man, chain saw, concrete saw, electric hand grinder, all electric bush and chipping hammers, flagmen, forklift operators, form setter (street or highway), metal form setters, heaters, mesh handlers on walkways, streets and roadways outside building, gunnite laborers, hand spiker, introflax burning rod, joint makers, mason tenders, multi-trade tender, pipe layers, plaster tenders, powderman helpers, power driven Georgia buggies, power posthole diggers, railroad laborers, sandblaster laborers, scow man and deck hand, signal man, sweeper and cleaner machines, vibrator operators, walk behind trenching machines, mortar mixer machines, water pumpmen, and environmental laborers - nuclear, radiation, toxic and hazardous waste - Level C:

BUILDING	*BASE RATE	$14.13
	FRINGE BENEFITS	5.32

BUILDING GROUP 3:
Gunnite nozzleman and gunnite nozzle machine operator, sand blaster nozzleman, concrete or grout pumpman, plaster pumpman:

BUILDING	*BASE RATE	$14.33
	FRINGE BENEFITS	5.32

BUILDING GROUP 4:
Powderman and blaster, and environmental laborer - nuclear, radiation, toxic and hazardous waste - Level B:

BUILDING	*BASE RATE	$14.43
	FRINGE BENEFITS	5.32

CLASSIFICATIONS RATE AND FRINGE BENEFITS

LABORERS/ BUILDING: (Continued)

BUILDING GROUP 5:
Caisson holes (6 ft. and over) pressure and free air including tools, construction specialist, and environmental laborer-nuclear, radiation, toxic and hazardous waste - Level A:

BUILDING	*BASE RATE	$14.93
	FRINGE BENEFITS	5.32

BUILDING GROUP 6:
Tunnel man and tunnel sand miner, cofferdam (pressure and free air), sand hog or mucker (pressure or free air):

BUILDING	*BASE RATE	$15.23
	FRINGE BENEFITS	5.32

***Employees handling chemically treated materials which are harmful to the skin shall receive an additional $.25 above base rate. Any employee working on high work such as towers or smoke stacks or any type of work putting the employee 50 feet above the ground or a solid floor shall receive an additional $.50 per hour above the base rate. Any employee working on boilers, kilns, melting tanks, furnaces, or when refractory is done using live fire, drying fires, heatups or any hot work shall receive an additional 25% premium above the base rate.**

LABORERS/ HEAVY HIGHWAY:

HEAVY HIGHWAY GROUP 1:
Aging and curing of concrete (any mode or method), asbestos abatement worker, asphalt plant laborers, asphalt laborers, batch truck dumpers, carpenter tenders, cement mason tenders, cleaning of machines, concrete laborers, demolition laborers, dredging laborers, drill helper, environmental laborer - nuclear, radiation, toxic and hazardous waste - Level D, flagmen, grade checkers, all hand digging and hand back filling, highway marker placers, landscaping laborers, mesh handlers and placers, puddler, railroad laborers, rip-rap and grouters, right of way laborers, sign, guard rail and fence installers (all types), signal men, sound barrier installer, storm and sanitary sewer laborers, swampers, truck spotters and dumpers, and wrecking of concrete forms:

HEAVY & HIGHWAY	BASE RATE	$16.34
	FRINGE BENEFITS	7.38

CLASSIFICATIONS RATE AND FRINGE BENEFITS

LABORERS/ HEAVY HIGHWAY: (Continued)

HEAVY HIGHWAY GROUP 2:
Batter board men (sanitary and storm sewer), brickmason tenders, mortar mixer operator, burner and welder, bushhammers, chain saw operator, concrete saw operators, deckhand scow man, dry cement handlers, environmental laborers - nuclear, radiation, toxic and hazardous waste - Level C, forklift operators for masonry, form setters, green concrete cutting, hand operated grouter and grinder machine operator, jack hammers, lead paint abatement, pavement breakers, paving joint machine, pipe layers-laser operators (non-metallic), plastic pipe fusion, power driven Georgia buggy or wheelbarrow, power post hole diggers, precast manhole setters, walk-behind tampers, walk-behind trenchers, sand blasters, concrete chippers, surface grinders, vibrator operators, wagon drillers:

HEAVY & HIGHWAY	BASE RATE	$16.59
	FRINGE BENEFITS	7.38

HEAVY HIGHWAY GROUP 3:
Air track driller (all types), asphalt luteman and rakers, gunnite nozzleman, gunnite operators and mixers, grout pump operator, powderman and blaster, side rail setters, rail paved ditches, screw operators, tunnel laborers (free air), and water blasters:

HEAVY & HIGHWAY	BASE RATE	$16.64
	FRINGE BENEFITS	7.38

HEAVY HIGHWAY GROUP 4:
Caisson workers (free air), cement finishers, environmental laborer - nuclear, radiation, toxic and hazardous waste - Levels A and B, miners and drillers (free air), tunnel blasters, and tunnel muckers (free air):

HEAVY & HIGHWAY	BASE RATE	$17.24
	FRINGE BENEFITS	7.38

MARBLE, TILE & TERRAZZO:

Finishers:	BASE RATE	$19.59
	FRINGE BENEFITS	3.70
Workers:	BASE RATE	$13.34
	FRINGE BENEFITS	3.05

CLASSIFICATIONS	RATE AND FRINGE BENEFITS	
MILLWRIGHTS:	BASE RATE	$19.34
	FRINGE BENEFITS	8.58

OPERATING ENGINEERS:

OPERATING ENGINEERS/ BUILDING:

BUILDING CLASS A:
Auto Patrol, Batcher Plant, Bituminous Paver, Cableway, Carrydeck Crane, Central Compressor Plant, Clamshell, Concrete Mixer (21 cu. ft. or over), Concrete Pump, Crane, Crusher Plant, Derrick, Derrick Boat, Ditching and Trenching Machine, Dragline, Dredge Operator, Dredge Engineer, Elevating Grader and all types of Loaders, Heavy Equipment Robotics Operator/ Mechanic, Hoe-Type Machine, Hoist (1 drum when used for stack or chimney construction or repair), Hoisting Engine (2 or more drums), Horizontal Directional Drill Operator, Hydraulic Boom Trucks, Locomotive, Mechanically Operated Laser Screed, Motor Scraper, Carry-all Scoop, Bulldozer, Heavy Duty Welder, Mechanic, Orangepeel Bucket, Overhead Crane, Piledriver, Power Blade, Motor Grader, Roller (bituminous), Scarifier, Shovel, Tractor Shovel, Truck Crane, Winch Truck, Push Dozer, Forklift (regardless of lift height and except when used for masonry construction), Telescoping Type Forklift, Highlift, All types of Boom Cats, Core Drill, Hopto, Tow or Push Boat, A-Frame Winch Truck, Concrete Paver, Gradeall, Hoist, Hyster, Pumpcrete, Ross Carrier, Boom, Tail Boom, Rotary Drill, Hydro Hammer, Mucking Machine, Rock Spreader attached to equipment, Scoopmobile, KeCal Loader, Tower Cranes (French, German and other types), Hydrocrane, Backfiller, Gurries, sub-Grader, Tunnel Mining Machines including Moles, Shields, or similar types of Tunnel Mining Equipment:

BUILDING	*BASE RATE	$21.00
	FRINGE BENEFITS	9.65

***Operators on cranes with boom one-hundred fifty feet (150') and over including jib, shall receive one dollar ($1.00) above base rate, two-hundred twenty-five feet (225') and over including jib shall receive one dollar and fifty-cents ($1.50) above base rate. All cranes with piling leads will receive one dollar ($1.00) above base rate regardless of boom length.**

CLASSIFICATIONS RATE AND FRINGE BENEFITS

OPERATING ENGINEERS/ BUILDING: (Continued)

BUILDING CLASS B:
All Air Compressors (over 900 cfm), Bituminous Mixer, Joint Sealing Machine, Concrete Mixer (under 21 cu. ft), Form Grader, Roller (rock), tractor (50 HP and over), Bull Float, Finish Machine, Outboard Motor Boat, Flexplane, Fireman, Boom Type Tamping Machine, Truck Crane Oiler, Greaser on Grease Facilities servicing Heavy Equipment, Switchman or brakeman, Mechanic Helper, Whirley Oiler, Self-Propelled Compactor, Tractair and Road Widening Trencher and Farm Tractor with Attachments (except backhoe, highlift and endloader), Elevator (regardless of ownership when used for hoisting any building materials), Hoisting Engineer (1 drum or buck hoist), Forklift (when used for masonry construction, firebrick masonry excluded), Well Points, Grout Pump, Throttle-Valve Man, Tugger, Electric Vibrator Compactor:

BUILDING	BASE RATE	$18.26
	FRINGE BENEFITS	9.65

BUILDING CLASS C:
Bituminous Distributor, Cement Gun, Conveyor, Mud Jack, Paving Joint Machine, Roller (earth), Tamping Machine, Tractors (under 50 HP), Vibrator, Oiler, Concrete Saw, Burlap and Curing Machine, Hydro-Seeder, Power Form handling Equipment, Deckhand Steersman, Hydraulic Post Driver and Drill Helper:

BUILDING	BASE RATE	$17.49
	FRINGE BENEFITS	9.65

Employees assigned to work below ground level are to be paid ten percent (10%) above base wage rate. This does not apply to open cut work.

OPERATING ENGINEERS/ HEAVY HIGHWAY:

Continued on next page.

CLASSIFICATIONS RATE AND FRINGE BENEFITS

OPERATING ENGINEERS/ HEAVY HIGHWAY: (Continued)

HEAVY HIGHWAY CLASS A:
A-Frame Winch Truck, Auto Patrol, Backfiller, Batcher Plant, Bituminous Paver, Bituminous Transfer Machine, All types of Boom Cats, Bulldozer, Cableway, Carry-All Scoop, Carry Deck Crane, Central Compressor Plant Operator, Clamshell, Concrete Mixer (21 cu. ft. or over), Concrete Paver, Truck-Mounted Concrete Pump, Core Drills, Crane, Crusher Plant, Derrick, Derrick Boat, Ditching and Trenching Machine, Dragline, Dredge Operator, Dredge Engineer, Earth Movers, Elevating Grader and all types of Loaders, Grade-All, Gurries, Heavy Equipment Robotics Operator/Mechanic, Highlift, Hoe-Type Machine, Hoist (two or more drums), Hoisting Engine (two or more drums), Horizontal Directional Drill Operator, Hydraulic Boom Truck, Hydrocrane, Hyster, KeCal Loader, Letourneau, Locomotive, Mechanic, Mechanically Operated Laser Screed, Mechanic Welder, Mucking Machine, Motor Scraper, Orangepeel Bucket, Piledriver, Power Blade, Pumpcrete, Push Dozer, Rock Spreader attached to Equipment, All Rotary Drills, Roller (bituminous), Scarifier, Scoopmobile, Shovel, Side Boom, Subgrader, Tailboom, Telescoping Type Forklift, Tow or Push Boat, Tower Cranes (French, German and other types), Tractor Shovel, Truck Crane, Tunnel Mining Machines including Moles, Shields, or Similar types of Tunnel Mining Equipment:

HEAVY & HIGHWAY	**BASE RATE	$22.15
	FRINGE BENEFITS	10.40

****Operators on cranes with booms one hundred fifty feet (150') and over including jib shall receive $.50 above base rate.**

HEAVY HIGHWAY CLASS B:
All Air Compressors (over 900 cu. ft. per min.), Bituminous Mixer, Boom Type Tamping Machine, Bull Float, Concrete Mixer (under 21 cu. ft.), Electric Vibrator Compactor/Self-Propelled Compactor, Elevator (one drum or buck hoist), Elevator (regardless of ownership when used to hoist building material), Finish Machine, Firemen, Flex-Plane, Forklift (regardless of lift height), Form Grader, Hoist (one drum), Joint Sealing Machine, Mechanic Helper, Outboard Motor Boat, Power Sweeper (riding type), Roller (rock), Ross Carrier, Skid Mounted or Trailer Mounted Concrete Pumps, Switchman or Brakeman, Throttle Valve Man, Tractair and Road Widening Trencher, Tractor (50 HP and over), Truck Crane Oiler, Tugger, Welding Machine, Well Points, and Whirley Oiler:

HEAVY & HIGHWAY	BASE RATE	$19.73
	FRINGE BENEFITS	10.40

CLASSIFICATIONS RATE AND FRINGE BENEFITS

OPERATING ENGINEERS/ HEAVY HIGHWAY: (Continued)

HEAVY HIGHWAY CLASS B2:
Greaser on Grease Facilities servicing Heavy Equipment:

HEAVY & HIGHWAY	BASE RATE	$20.11
	FRINGE BENEFITS	10.40

HEAVY HIGHWAY CLASS C:
Bituminous Distributor, Burlap and Curing Machine, Caisson Drill and Core Drill Helper (track or skid mounted), Cement Gun, Concrete Saw, Conveyor, Deckhand Oiler, Grout Pump, Hydraulic Post Driver, Hydro Seeder, Mud Jack, Oiler, Paving Joint Machine, Power Form Handling Equipment, Pump, Roller (earth), Steermen, Tamping Machine, Tractors (under 50 H.P.) and Vibrator:

HEAVY & HIGHWAY	BASE RATE	$19.47
	FRINGE BENEFITS	10.40

Employees assigned to work below ground level are to be paid ten percent (10%) above base wage rate. This does not apply to open cut work.

PAINTERS:

Brush & Roller:	BUILDING	BASE RATE	$14.35
		FRINGE BENEFITS	3.87
Spray& Sandblast:	BUILDING	BASE RATE	$14.85
		FRINGE BENEFITS	3.87
Brush & Roller:	HEAVY & HIGHWAY	BASE RATE	$18.20
		FRINGE BENEFITS	5.08
Drywall Finishers & Plasterers:	HEAVY & HIGHWAY	BASE RATE	$18.45
		FRINGE BENEFITS	5.08

CLASSIFICATIONS		RATE AND FRINGE BENEFITS	
PAINTERS: (Continued)			
Spray, Sandblast, Power Tools, Waterblast, Steam Cleaning; Brush & Roller of Mastics, Creosotes, Kwinch Koate and Coal Tar Epoxy:			
	HEAVY & HIGHWAY	BASE RATE	$19.20
		FRINGE BENEFITS	5.08
Spray of Mastics, Creosotes, Kwinch Koate and Coal Tar Epoxy:			
	HEAVY & HIGHWAY	BASE RATE	$20.20
		FRINGE BENEFITS	5.08
PLASTERERS:		BASE RATE	$20.65
		FRINGE BENEFITS	5.85
PLUMBERS & PIPEFITTERS:		BASE RATE	$26.31
		FRINGE BENEFITS	10.61
ROOFERS: (Excluding Metal Roofs)		BASE RATE	$17.90
		FRINGE BENEFITS	5.73
SHEETMETAL WORKERS: (Including Metal Roofs)		BASE RATE	$26.35
		FRINGE BENEFITS	9.99
SPRINKLER FITTERS:		BASE RATE	$25.05
		FRINGE BENEFITS	11.00
BUILDING TRUCK DRIVERS:			
Truck Helper and Warehouseman:			
	BUILDING	BASE RATE	$15.60
		*FRINGE BENEFITS	6.23

CLASSIFICATIONS — RATE AND FRINGE BENEFITS

TRUCK DRIVERS:

TRUCK DRIVERS/ BUILDING:

Driver - 3 tons and under, Greaser, Tire Changer and Mechanic Helper:

BUILDING	BASE RATE	$15.72
	*FRINGE BENEFITS	6.23

Driver - over 3 tons, Drivers, Semi-Trailer or Pole Trailer; Dump Trucks, Tandem Axle; Farm Tractor when used to pull building material or equipment:

BUILDING	BASE RATE	$15.83
	*FRINGE BENEFITS	6.23

Drivers, Concrete Mixer Trucks (all types, hauling on job sites only); Truck Mechanics:

BUILDING	BASE RATE	$15.90
	*FRINGE BENEFITS	6.23

Drivers, Euclid and other Heavy Earth Moving Equipment and Low Boy, Winch Truck and A-Frame Truck and Monorail Truck when used to transport building materials, Forklift Truck when used inside warehouse or storage area:

BUILDING	BASE RATE	$16.00
	*FRINGE BENEFITS	6.23

Employees who perform work either on or hauling to or from any hazardous or toxic waste site will receive $4.00 in addition to their base rate of pay.

***TRUCK DRIVER Fringe benefits - Apply to each employee (whose name appears on the payroll that week) who has been employed a minimum of twenty (20) calendar days within any ninety (90) consecutive day period for that employer.**

TRUCK DRIVERS/ HEAVY & HIGHWAY:

Mobile batch truck helper:	HEAVY & HIGHWAY	BASE RATE	$16.57
		**FRINGE BENEFITS	7.34

Greaser, tire changer and mechanic helper:

HEAVY & HIGHWAY	BASE RATE	$16.68
	**FRINGE BENEFITS	7.34

CLASSIFICATIONS RATE AND FRINGE BENEFITS

TRUCK DRIVERS/ HEAVY & HIGHWAY: (Continued)

Driver-single axle dump and flatbed truck, semi-trailer or pole trailer when used to pull building materials and equipment, tandem axle dump truck, driver of distributors, driver on mixer trucks(all types) & truck mechanic:

HEAVY & HIGHWAY	BASE RATE	$16.86
	**FRINGE BENEFITS	7.34

Driver-Euclid and other heavy earthmoving equipment and low-boy, articulator, cat truck, 5-axle wheel, winch truck and A-Frame truck when used in transporting materials, Ross Carrier, forklift truck when used to transport building materials, driver on pavement breakers:

HEAVY & HIGHWAY	BASE RATE	$16.96
	**FRINGE BENEFITS	7.34

****TRUCK DRIVER FRINGE BENEFITS apply to employees who have been employed a minimum or twenty (20) calendar days within any ninety (90) consecutive day period of that employer.**

END DOCUMENT CR-2-007
MAY 18, 2005

PAYMENT BOND

KNOW ALL PERSONS BY THESE PRESENTS: that

_____

(Name of Contractor)

_____

(Address of Contractor)

a _____, hereinafter called PRINCIPAL and
(Corporation, Partnership, or Individual)

_____

(Name of Surety)

hereinafter called SURETY, are held and firmly bound unto _____

_____

(Name of Owner)

_____

(Address of Owner)

hereinafter called OWNER, and unto all persons, firms and corporations who or which may furnish labor, or who furnish materials to perform as described under the contract and to their successors and assigns in the total aggregate penal sum of _____ Dollars ($ _____) in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITIONS OF THIS OBLIGATION is such that whereas, the PRINCIPAL entered into a certain contract with the OWNER, dated the _____ day of _____, 20 __, a copy of which is hereto attached and made a part hereof for the construction of: _____

_____

_____

NOW, THEREFORE, if the PRINCIPAL shall promptly make payment to all persons, firms, and corporations furnishing materials for or performing labor in prosecution of the WORK provided for in such contract, and any authorized extensions or modification thereof, including all amounts due for materials, lubricants, oil, gasoline, coal and coke, repairs on machinery, equipment and tools, consumed or used in connection with the construction of such WORK, and for all labor cost incurred in such WORK including that by a SUBCONTRACTOR, and to any mechanic or materialman lienholder whether it acquires its lien by operation of State or Federal law; then this obligation shall

be void, otherwise to remain in full force and effect.

PROVIDED, that beneficiaries or claimants hereunder shall be limited to the SUBCONTRACTORS, and persons, firms and corporations having a direct contract with the PRINCIPAL or its SUBCONTRACTORS.

PROVIDED, FURTHER, that the said SURETY for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to the WORK to be performed thereunder or the SPECIFICATIONS accompanying the same shall in any way affect its obligation on this BOND, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of this contract or to the WORK or to the SPECIFICATIONS.

PROVIDE FURTHER, that no suit or action shall be commenced hereunder by any claimant: (a) Unless claimant, other than one having a direct contract with the PRINCIPAL shall have given written notice to any two of the following: the PRINCIPAL, the OWNER, or the SURETY above named within ninety (90) days after such claimant did or performed the last of the work or labor, or furnished the last of the materials for which said claim is made, stating the materials were furnished, or for whom the work or labor was done or performed. Such notice shall be served by mailing the same by registered mail or certified mail, postage prepaid, in an envelope addressed to the PRINCIPAL, OWNER, or SURETY, at any place where an office is regularly maintained for the transaction of business, or served in any manner in which legal process may be served in the state in which the aforesaid project is located, save that such service need not be made by a public officer. (B) After the expiration of one (1) year following the date of which PRINCIPAL ceased work on said CONTRACT, is being understood, however, that if any limitation embodied in the BOND is prohibited by any law controlling the construction hereof, such limitation shall be deemed to be amended so as to be equal to the minimum period of limitation permitted by such law.

PROVIDED, FURTHER, that it is expressly agreed that this BOND shall be deemed amended automatically and immediately, without formal and separate amendments hereto, upon amendment to the Contract not increasing the contract price more than 20 percent, so as to bind the PRINCIPAL and the SURETY to the full and faithful performance of the Contract as so amended. The term "Amendment", wherever used in this BOND and whether referring to this BOND, the contract shall include any alteration, addition, extension or modification of any character whatsoever.

PROVIDED, FURTHER, that no final settlement between the OWNER and the CONTRACTOR shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

WITNESS WHEREOF, this instrument is executed in _____ counterparts, each of which
Number

shall be deemed an original, this the _____ day of _____.

ATTEST:

_____ _____
(Principal) Secretary Principal

(SEAL)

By _____

_____
(Address)

_____ _____
Witness as to Principal

_____
(Address)

_____ _____
Surety

ATTEST:

_____ By _____
Witness as to Surety Attorney-in-Fact

_____ _____
(Address) (Address)

_____ _____

NOTE: Date of BOND must not be prior to date of CONTRACT.

If CONTRACTOR is partnership, all partners should execute BOND. IMPORTANT: Surety companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the State where the PROJECT is located.

PERFORMANCE BOND

KNOW ALL PERSONS BY THESE PRESENTS: that

_____

(Name of Contractor)

_____

(Address of Contractor)

a _____, hereinafter called Principal, and
(Corporation, Partnership, or Individual)

_____

(Name of Surety)

_____

(Address of Surety)

hereinafter called Surety, are held and firmly bound unto _____

_____

(Name of Owner)

_____

(Address of Owner)

hereinafter called OWNER, in the total aggregate penal sum of _____

_____ Dollars ($ _____)

in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal entered into a certain contract with the OWNER, dated the _____ day of _____ 20 _____, a copy of which is hereto attached and made a part hereof for the construction of:

_____

_____

_____

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms, conditions and agreements of said contract during the original term thereof, and any extensions thereof which may be granted by the OWNER, with or without notice to the SURETY and during the one year guaranty period and if the PRINCIPAL shall satisfy all claims and demands incurred under such contract, and shall fully indemnify and save harmless the OWNER from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the OWNER all outlay and expense which the OWNER may incur in making good any default, them this obligation shall be void, otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said SURETY, for value received hereby stipulates and agrees that no change, extension of time, alteration of addition to the terms of the contract or to WORK to be performed thereunder or the SPECIFICATIONS accompanying same shall in any way affect its obligation on this BOND, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the WORK or to the SPECIFICATIONS.

PROVIDED, FURTHER, that it is expressly agreed that the BOND shall be deemed amended automatically and immediately, without formal and separate amendments hereto, upon amendment to the Contract not increasing the contract price more than 20 percent, so as to bind the PRINCIPAL and the SURETY to the full and faithful performance of the CONTRACT as so amended. The term "Amendment", wherever used in this BOND, and whether referring to this BOND, the Contract shall include any alteration, addition, extension, or modification of any character whatsoever.

IN WITNESS WHEREOF, this instrument is executed in _____ counterparts, each one
Number

of which shall be deemed an original, this the _____ day of _____.

ATTEST:

_____ _____
(Principal) Secretary Principal

(SEAL)

By _____(s)

_____

_____ _____
(Witness as to Principal) (Address)

_____
(Address)

_____ _____
Surety

ATTEST:

_____ By _____
Witness to Surety Attorney-in-Fact

_____ _____
(Address) (Address)

_____ _____

NOTE: Date of BOND must not be prior to date of Contract.

If CONTRACTOR is partnership, all partners should execute BOND.

IMPORTANT: Surety companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the State where the Project is located.

CONTRACT AGREEMENT

THIS AGREEMENT, made this _____ day of _____, 20____

by and between _____
(Owner)

acting through its _____ hereinafter called
(Mayor, Utility Commission, Chairmen)

the OWNER and _____ doing business as
(Contractor)

_____ of the city of _____.
(an individual) (partnership) (a corporation)

_____, County, State of _____

hereinafter called the CONTRACTOR.

WITNESSETH: That for and in consideration of the payments and agreements hereinafter mentioned:

The CONTRACTOR will commence and complete the construction of

_____

_____.

The CONTRACTOR will furnish all of the materials, supplies, tools, equipment, labor and other services necessary for the construction and completion of the project described herein.

The CONTRACTOR will commence work under this contract on or before the date to be specified by the Owner, in a written "Notice to Proceed" and will fully complete the project within _____ consecutive calendar days thereafter. The CONTRACTOR further agrees to pay as liquidated damages, the sum of $_____ For each consecutive calendar day that the work remains uncomplete after the expiration date of this contract, as modified by Change Order.

The CONTRACTOR agrees to perform all of the WORK described in the CONTRACT DOCUMENTS for the sum of $_____, or as shown in the Bid Schedule, Pages BS _____ thru BS _____.

The term "CONTRACT DOCUMENTS" means and includes the following: SPECIFICATIONS prepared or issued by HMB Professional Engineers, Inc.

TITLE	DESIGNATION
Advertisement for Bids	AD
Instructions to Bidders	IB
General Conditions	GC
Labor Regulations	LR
Performance and Payment Bond	PB
Contract Agreement	CON
Notice of Award	NA
Notice to Proceed	NP
Change Order Format	CO
Special Conditions	SC
Technical Specifications	TS
Bid Schedule	BS

DRAWINGS prepared by HMB Professional Engineers, Inc.
numbered _____ through _____ and dated _____.

The following ADDENDA are included as part of this Contract:

ADDENDUM NO. _____

DATE

The OWNER shall make progress payments as the work is completed, in accordance with the appropriate Articles of the General Conditions.

Final payment shall be due thirty (30) days after completion and acceptance of the work.

Before issuance of final certificate, the Contractor shall submit evidence satisfactory to the Owner that all payrolls, material bills, and other indebtedness connected with the work have been paid.

If, after the work has been substantially completed, full completion thereof is materially delayed through no fault of the Contractor, and the Engineer so certifies, the Owner shall, upon certificate of the Engineer and without terminating the contract, make payment of the balance due for that portion of the work fully completed and accepted. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

IN WITNESS WHEREOF, the parties hereto have executed, or caused to be executed by their duly authorized officials, this Agreement in _____ copies each of which shall be deemed an original on the date first above written.

This Agreement shall be binding upon all parties hereto and their respective heirs, executors, administrators, successors, and assigns.

_____
CONTRACTOR

ATTEST:

_____ By_____
Title Title
(SEAL)

_____
OWNER

ATTEST:

_____ By_____
Title Title

NOTICE OF AWARD

TO: _____

_____

_____

PROJECT Description _____

_____

_____

The OWNER has considered the BID submitted by you for the above described WORK in response to its Advertisement for Bids dated _____ 20 _____, and Instructions to Bidders.

You are hereby notified that your BID has been accepted for items in the amount of $ ___ _____, in accordance with the Bid Schedule.

You are required by the Instructions to Bidders to execute the Agreement and furnish the required Contractor's Performance Bond and Payment Bond within ten calendar days from the date of this Notice to you.

If you fail to execute said Agreement and to furnish said bonds within ten days from the date of this Notice, said OWNER will be entitled to consider all your rights arising out of the OWNER'S acceptance of your BID as abandoned and as a forfeiture of your Bid Bond. The OWNER will be entitled to such other rights as may be granted by law.

You are required to return an acknowledged copy of this NOTICE OF AWARD to the OWNER.

Dated this _____ day of _____, 20 _____.

_____

Owner

By_____

Title_____

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE OF AWARD is hereby acknowledged by

_____ this the _____ of

_____, 20 _____.

_____

Contractor Title

NOTICE TO PROCEED

TO _____ DATE:_____

_____ PROJECT:_____

_____ _____

_____ _____

_____

You are hereby notified to commence work in accordance with the Agreement dated _____, 20 _____, on or before _____, 20 _____, and you are to complete the WORK within _____ consecutive calendar days thereafter.

The date of completion of all WORK is therefore _____, 20_____.

_____

OWNER
By_____

Title_____

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE TO PROCEED is hereby acknowledged by _____, this the _____ day of _____, 20 _____.

_____

By_____

Title_____

CONTRACT CHANGE ORDER	ORDER NO.
	DATE
	STATE
CONTRACT FOR	COUNTY

OWNER

To: _____
(Contractor)

You are hereby requested to comply with the following changes from the contract plans and specifications:

Description of Changes (Supplemental Plans and Specifications Attached)	DECREASE in Contract Price	INCREASE in Contract Price
	$	$
TOTALS	$	$
NET CHANGE IN CONTRACT PRICE	$	$

JUSTIFICATION:

The Original amount of the Contract is: _____ Dollars ($_____).

The amount of the current Contract including previous Change Orders: _____ Dollars ($_____).

The amount of the Contract will be **(Increased Decreased)** by this Change Order the sum of _____ Dollars ($_____).

The Contract Total including this and previous Change Orders will be: _____ Dollars ($_____).

The Contract period provided for completion will be increased: _____ Days

This document will become a supplement to the contract and all provisions will apply hereto.

Requested _____ _____
(Owner) (Date)

Recommended _____ _____
(Owner's Architect/Engineer) (Date)

Accepted _____ _____
(Contractor) (Date)

Approved By _____ _____
(Name and Title) (Date)

This information will be used as a record of any changes to the original construction contract.

SPECIAL CONDITIONS

1. PROJECT FUNDING

Contractors bidding the project should be aware that funding is provided by a KIA Tobacco Grant, Special Appropriation EPA Grant, and KRWA Loan.

2. CONFLICTING SECTIONS/STATEMENTS IN THE TECHNICAL SPECIFICATIONS

It shall be noted that if any provision in these Technical Specifications is in conflict and/or is inconsistent with any other section, then the most stringent shall apply per the interpretation of the ENGINEER.

3. FEDERAL/STATE/LOCAL REGULATIONS

The Contractor shall abide by all local and state laws or ordinances to the extent that such requirements do not conflict with federal laws or regulations.

4. EPA SPECIAL CONDITIONS

a. Reasonable care shall be taken during construction to avoid damage to vegetation. Ornamental shrubbery and tree branches shall be temporarily tied back, where appropriate, to minimize damage. Trees that receive damage to branches shall be trimmed of those branches to improve the appearance of the tree. Tree trunks receiving damage from equipment shall be treated with a tree dressing.

b. Change orders to the construction contract must comply with DOW Procurement Guidance for Construction and Equipment Contracts.

c. Change orders exceeding $25,000 require cost, pricing and certification.

d. Contractor shall implement Best Management Practices as described in the Kentucky Best Management Practices for Construction Activities prepared by Division of Conservation and Division of Water, Natural Resources and Environmental Protection Cabinet.

PART 1 - PROJECT DESCRIPTION

1.01 Description

A) Description of Work

The work to be accomplished under this section shall consist of furnishing the equipment necessary for a complete automatic control and monitoring system to function as specified herein and as shown on the drawings. The system integrator's shall furnish a completely integrated all solid-state radio telemetry base Supervisory Control and Data Acquisition (SCADA) system. It shall be the system integrator's responsibility to supply a system that is compatible with existing equipment, new equipment supplied by others as part of this contract, and equipment supplied in other contracts. The complete system shall be designed, fabricated, programmed, tested, started up, and warranted by a single supplier to insure a single source of responsibility.

B) Scope of Work

This section covers a radio telemetry based SCADA and Instrumentation System to include:
(3) Water Tower Remote Units,
(2) Pump Station Remote Units,
(1) Operator Display Consoles, and Central Terminal Unit.

The Central Terminal Unit located at water office shall be the basis of control and shall interrogate the remote units to send control data and receive level, pressure, flow, and status and alarm data as detailed from each remote unit.

C) System Integrator Shall Supply:

1) All equipment required by schedule.
2) All labor for start-up of the system.
3) Engineering submittal and shop drawings prior to installation.
4) All the paper work and fees necessary to obtain a FCC radio license in the name of the Owner.
5) All ancillary equipment, hardware, software, and appurtenances needed for proper installation and operation of equipment.
6) Provide spare parts and maintenance tools as described below.
7) Operations and maintenance manuals as detailed below.
8) All start-up labor and services.
9) All operators training.

D) General Contractor/Owner Shall Supply:

1) Access and easements as needed for all sites.
2) 120VAC power at all sites.
3) All labor for installation of the system.
4) Pressure sensing taps for all sensing points in the system.
5) Meter pits for sensing tank levels or line pressures in the system.
6) Desks and chairs for Operator Display Console computer.

1.02 Quality Assurance

A) Manufacturer's Qualifications

The system specified herein shall be the product of a manufacturer who can demonstrate at least ten (10) years of satisfactory experience in furnishing and installing comparable radio telemetry/control systems for water and wastewater installations.

The manufacturer of this system shall maintain a 24-hour available inventory of all replaceable modules to assure the Owner of prompt maintenance service and a single source of responsibility. The manufacture and shall certify this to the Engineer in writing at the time of bidder pre-qualification.

A) Codes & Standards

The control system and its components shall comply will all applicable requirements of the following:

1) Electrical Code Compliance (National & Local)
2) NEMA Compliance
3) IEEE Compliance
4) EIA Compliance
5) FCC Compliance

B) Approved System Integrators

1) Micro-Comm, Inc. Olathe, Kansas
2) Approved Equal:.

1.03 Submittals

Complete submittal shall be provided to the engineer for approval prior to equipment fabrication. The submittal data shall include the following:

A) Product Data

Provide product data sheets for each instrument and component supplied in the system. The data sheets shall show the component name as used on reference drawings, manufacturer's model number or other product designator, input and output characteristics, scale or ranges selected, electrical or mechanical requirements, and materials compatibility.

B) Shop Drawings

Provide drawings for each panel showing the wiring diagrams for control circuits and interconnections of all components. The drawings shall include wiring diagrams for all remote devices connected to the panel.

C) Panel Layout Drawings

A front panel and sub-panel layout shall be included as part of each control panel drawing. Components shall be clearly labeled on the drawing.

D) Installation Drawings

Typical installation drawings applicable to each site in the system shall be included.

E) Operator Interface Software

The submittal shall include a generic but detailed technical description of the Operator's Interface Software as proposed for this system including:

1) Sample text screens and menus
2) Sample graphics screens
3) Sample report logs and printed graphs

1.04 Maintenance Information

A) Maintenance Data Manuals

Submit maintenance manuals and "as built" drawings on all items supplied with the system. The manuals and drawings are to be bound into one or more books as needed. In addition to "as built" engineering submittal data and drawings, the manual shall include trouble shooting guides and maintenance and calibration data for all adjustable items.

Systems that require the zero or span adjustments of level transducers be adjusted to specific site conditions shall require a spare adjusted transducer for each different site location.

1.05 Job Conditions

All instruments and equipment shall be designed to operate under the environmental conditions where they are to perform their service. The equipment shall be designed to handle lightning and transient voltages as normal environmental hazards. The environmental conditions are as follows:

A) Outdoor

The equipment will be exposed to direct sunlight, dust, rain, snow, ambient temperatures from -20 to +120 degrees F, relative humidity of 10 to 100 percent, and other natural outdoor conditions. The installations shall be hardened to with stand normal vandalism.

B) Indoor
The equipment will be capable of operating in ambient temperatures of +32 to +130 degrees F and relative humidity of 20 to 100 percent.

1.06 Delivery, Storage, and Handling

All items shall be stored in a dry sheltered place, not exposed to the outside elements, until ready for installation. All items shall be handled with appropriate care to avoid damage during transport and installation.

1.07 Sequencing & Scheduling

A) Coordination
The Systems Integrator shall coordinate with other electrical and mechanical work including wires/cables, raceways, electrical boxes and fittings, controls supplied by others, and existing controls, to properly interface installation and commissioning of the control system.

B) Sequence
Sequence installation and start-up work with other trades to minimize downtime and to minimize the possibility of damage and soiling during the remainder of the construction period.

PART 2 – PRODUCTS

2.01 Distributed Control Operation Description

A) General
The control system shall use "Programmable Logic Controllers" (PLCs) for the Central Terminal Unit (CTU) and Remote Terminal Units (RTUs). The system shall be a "distributed intelligence" type control system that provides the features of both a "Central Control" (ie centralized control of RTUs from the CTU) and "Distributed Control" (ie RTU self control using local inputs and peer-to-peer communications) in to a unified control system. The control system shall support master-slave (ie CTU to RTU) and peer-to-peer (i.e. RTU to RTU) communications to provide completely automatic control with no single point of system failure.

The control system shall be capable of implementing radio, leased phone-line, dial-up phone-line, and high speed data highway communications as required by these specifications. Each remote site in the system shall be assigned a unique digital address.

The software programs used at all locations shall be stored in non-volatile EEPROM or Flash type memories that are field re-programmable using software detailed later in these specifications. The system shall be "self-initializing" and not require operator intervention after power interruptions, transients from lightning storms, or component changes. All units in the

system shall include "watch-dog" circuitry to insure automatic restarts of the system.

The term "Central Control Unit" shall refer to the combination of computers and display devices used at the Main Control location. The "Central Unit" shall be composed of two separate computer systems communicating over a high-speed serial data highway. The first computer (called the Central Terminal Unit or CTU) shall provide all communications with remote units, local inputs and outputs, and local hardware display devices. The second computer (called the Operator Display Console or ODC) shall be responsible for the operator interface to the system and provide display, alarm, and logging of all data.

The "Central Terminal Unit" (CTU) shall be a PLC and provide the primary control of the system with operator input from the Operator Display Console (ODC) and/or the hardware operator interface as detailed later in these specifications. The CTU shall address each remote site in sequence, to send command data and receive status, alarm, flow, pressure, and level data as required from each site. The Central Unit shall indicate, display, alarm, and record (by CTU hardware and/or ODC software as detailed in the Central Unit section of this specification) all information received. Data received shall be compared to set points, hand-off-auto control selections, and pump control logic to generate control outputs.

The system shall be capable of supporting multiple Central Units with mixed and overriding control responsibilities. Each Central Unit shall be responsible for polling and controlling the operation of its assigned RTUs. Each Central Unit shall pass information on its RTUs to the Main Central Unit and receive information on RTUs assigned to other Central Units as needed for alarm, display, and control. Each Central Unit shall be capable (manually initiated) of interrogating and/or overriding control of the other Central Units' RTUs. The "control overridden" RTU shall indicate this condition to its associated Central Unit.

B) Central Unit "Centralized Control" Software Features

The Central Unit control algorithms shall have the ability to integrate both hardware and software operator inputs at the Central Unit along with hardware inputs at the remote sites in to a cohesive automatic operating control system. As data is received, changes, or lost (i.e. a loss of signal from a RTU or CTU), the Central Unit control logic shall automatically adjust the controlling algorithm to the new situation. At a minimum the control logic shall provide the following features:

1) Monitor input conditions at RTUs to determine the validity and/or usability of controlling input signals (i.e. altitude valves must be open before controlling pumps from the associated tank level). Additionally, determine the correctness of generating pump call commands (i.e. monitoring high discharge and low suction cut-off controls at pump stations) before starting or running pumps.

2) Integrate fully automatic control of up to 8 pumps (at up to 8 separate locations) from up to 8 different levels. The Central Unit shall be able to automatically transfer control from one level to another or from one pump to another in the event of RTU failure.

3) Automatic alternation/staging type operation pumps of identical or differing capacities. The CTU shall integrate different combinations of pumps in to the operation of each stage and automatically choosing alternate combinations of pumps for each stage should a pump fail or otherwise not be available (i.e. HOA is off). The CTU shall automatic alternate like sized pumps and automatic transfer to the next available pumping stage in the event of pump failure.

4) Automatic transfer of pump call to the next available pump on pump failure with out waiting for the controlling level, pressure, or flow to degrade to the next start level.

5) The Central Unit shall be capable of integrating both software (on the ODC) and hardware HAND/OFF/AUTO control selections at the Central Unit with the existing control panel HOA selector switches at remote units (if specifically listed in the RTU input/output requirements).

6) Automatic staging of in-line pump station operation including: starting of downstream pump stations on confirmation of upstream pumps running, implementing alternate course of action during pump failure, and monitoring station pressures to enable pump calls.

7) Peak power load management by comparing current tank levels and tank fill rates for all tanks in the system to operator inputs for peak period inhibit/restore times and generating pump start commands to top-off tank levels prior to the beginning of the peak demand period.

C) **RTU "Distributed" Control Software Features**

All RTUs shall be capable of providing local control to augment and/or replace Central Control operations as detailed in the appendix. Setpoints for "distributed" control at the RTUs shall be operator settable from the Central Unit, an optional RTU front panel Keypad & Display Unit, and/or an optional portable computer. The RTUs shall be capable of implementing the following control operations:

1) Provide for High Discharge Cut-off and Low Suction Cut-off control of pumps from locally entered setpoints at RTUs equipped with suction and discharge pressure transmitters and/or from existing pressure switches.

2) Automatic Pressure/Flow pump staging operation of pumps of different sizes (including variable speed pumps) from local discharge pressure and discharge flow inputs in a closed-loop system. The pumps shall be up-staged on decreasing discharge pressure and down-staged on

decreasing flow rate. The control shall include PID (Proportional Integral Derivative) loop control of variable speed pumps mixed with constant speed pumps for the various stages required.

3) "Compound Loop" PID control of final devices (ie chemical feeders) from multiple inputs (ie flow rate and a chemical process analyzer, such as chlorine residual).

4) The RTU shall be able to implement back-up modes of control in the event of CTU failure. Pump Station RTUs shall provide for back-up pressure control by comparing the discharge pressure or wetwell level transmitter (if required by these specifications) to locally stored setpoints for back-up pressure control or automatically switching to existing back-up pressure controls.

D) Multiple Levels of Back-up Control

The control system shall have four (4) levels of Back-up Control operation. The "Telemetry Control" lamp and the optional Central Control lamp (if listed in the RTU input/output lists) at the booster pump stations will indicate that the RTU is operating under telemetry control.

The primary level of operation will be under the guidance of the Operator's Display Console (ODC) computer at the "central" unit. This computer will provide the operator interface to the control system. Analysis of incoming data will determine the outgoing control signals. The remote sites will be monitored and/or controlled through the "central" unit per the designed mode of operation. Hand-Off-Auto and stop/start set point control of all remote devices will be accomplished by the "central" unit. In the event of a fault or an interruption of operation of the ODC, the operation of the system shall automatically revert to the secondary level of control.

The secondary level of control will be by the Central Terminal Unit computer (CTU) at the "central" unit in the event of a failure of the ODC. In this level the Central Terminal Unit shall continue fully automatic control the system from the last known operator set parameters. In either the primary or secondary level of control, pump station remotes will have the "Telemetry Control" lamp (and Central Control lamp if specified) turned on. Failure of the Central Unit to maintain communications with the remote units (ie failure of the CTU radio, CTU, or both CTU and ODC) shall cause the system to shift automatically to the third level of control.

The third level of control will employ peer-to-peer data transmission between specific RTUs (i.e. "water tower" remotes and their respective "booster pump stations") as detailed below. At this level of control the pump stations will act as "master units" to interrogate their own water tower RTUs for level data and generate their own pump commands based on locally stored set points. The peer-to-peer transmissions shall be accomplished via independent logic in the RTU, separate communications processors (ie Prosoft Modules)

sharing the primary communications channel, or a parallel back up RTU sharing the primary communications channel.

In the third level of control booster pump station remotes will have only the "Telemetry Control" lamp turned on. The peer-to-peer level of back-up control shall be established between the following remote sites:

KY 33 Tank	KY 33 Booster Pumps
Cummins Ferry Tank	Cummins Ferry Booster Pumps

In the event of failure in the peer-to-peer level of control, the system shall automatically revert to the last level of control on a station-by-station basis. If the system is operating in this level of control and a "water tower" fails to transmit its level or a "pump station" fails to respond to transmissions, only the failed tower/pump combinations will revert to the fourth level of control. The remainder of the system continues to function in third peer-to-peer level.

The fourth level of control will utilize any existing local back-up pressure controls at the booster pump stations or local back-up pressure control from the local RTU discharge pressure (or wetwell level) transmitter as detailed above. In this level of control neither the "Telemetry Control" nor "Central Control" lamps will be turned on. The back-up pressure controls will be inhibited in the first, second, and third levels of control. The Central Unit may automatically elect to shift a booster pump station RTU to this last level of control in the event of communication failure of the controlling water tower.

At all times the system shall attempt to operate in the highest level of control (lowest number) available. Whenever a failure is corrected, the system shall automatically transfer to the highest available level of control, always trying to reach primary control. Protective overriding controls (such as high discharge and low suction cut-off controls at booster pump stations) will be operative in all four levels.

Note that portions of the system utilizing "distributed" control as a normal mode of operations may operate in the third and/or forth level control at all times. The operator shall be able to command the Central Unit "override" the distributed modes at anytime to handle unusual situations.

2.02 Radio Channel Data Operations

A) General

The control system shall be specifically designed for radio channel data communications. All of the equipment required for operation of the system shall be directly owned by the Owner and included as part of this contract. Systems using third party repeaters, trunking masters, or leased equipment will not be allowed. The Systems Integrator shall select radio equipment as detailed below to insure reliable operation and be able to implement all

software features listed in this specification whether currently required or described as a "shall be capable" feature.

The overall system design and operation shall provide a 20db pad over the minimum required for operation on all primary data paths (primary paths may include data relays) to insure a 98% reliability of communications. Remote sites required to support peer-to-peer back-up control shall provide 30db of pad to insure operation under all weather conditions and provide a 99.9% communications reliability. The 20db and 30db pad requirements and FCC rule compliance shall be demonstrated (at no additional cost) to the Engineer at his request. The testing shall be accomplished using an IFR AM/FM 1000S communications analyzer or equal equipment.

B) Communications

The control system shall operate in a half-duplex mode over a single VHF (154 - 173MHz) radio frequency using "point-to-point" communication techniques. The RTUs shall monitor for the channel to avoid data collisions with other RTUs during peer-to-peer communications. The system shall be capable of sharing the radio channel with other radio telemetry system.

To facilitate system layout and future expansion all RTUs shall under the direction of the CTU be able to implement store-and-forward communications to relay data and commands to and from other RTUs as required to establish the desired path. Should the assigned relay site for a distant remote be inoperative, the Central Unit shall automatically choose another remote site to access the distant remote. Any RTU shall be able to provide automatic antenna switching as part of their relaying operations.
All data transmitted shall be in digital word form using FSK (frequency shift keying) transmission. All transmissions shall include the address of the sender and the receiver, and be subject to check sum, parity, and framing error checks, to insure a minimum data reliability of 1 error in 1,000,000,000 bits. Any transmissions that fail the data checking will be retried until correct. No data correction methods will be allowed. A plug-in RS232C data port shall be provided at all locations in the system to allow the use of a standard data terminal to view data exchanges between the sites and to provide a means of extensive de-bugging.

The system shall provide a complete data update at least once every (2) minutes with some functions updating faster as required by local system conditions.

C) Radio Channel Operation

The system shall be capable of operation on the narrow band splinter frequencies of the Private Land Mobile Radio Services within the Federal Communications Commissions (FCC) rules and regulations regarding these telemetry channels. The manufacture shall guarantee operation under co-channel conditions with other radio systems without interference to this system. FSK tones, data baud rates, transmitter output power, transmitter deviation, antenna gain, and antenna height shall be chosen to comply with

the FCC requirements Part 90 - Subpart 90.35 and 90.238 for the Industrial/Business frequency pools. The radio system shall specifically meet the operating requirement that the sum of the highest FSK frequency and the amount of deviation shall not exceed 1.7 kHz for 3F2 emission (or 2.8 kHz for 6F2 emission) as detailed by the FCC for the specific frequency assigned.

CTUs and RTUs shall be capable of automatically switching antennas and/or radios (including radios on different frequencies) during CTU-RTU, RTU-RTU, and store & forward communications. The antenna/radio switching at remote units shall automatically default back to RTU-CTU paths if communications are lost with the CTU.

D) FCC Licensing

The system manufacturer/supplier shall be responsible for collecting all information, generating all paper work, and paying all fees required obtaining a license on behalf of the Owner.

2.03 Radio Transceivers & Accessories

A) General

The radio transceivers shall be standard "un-modified" mobile two-way that an be tuned, aligned, and repaired at any two-way radio shop. Interface to external data modems shall be through the front panel microphone jack. The radios shall be synthesized and fully field programmable and include a built-in time-out timer to disable the transmitter after 0-60seconds. The units shall be tuned to FCC specifications for the specific frequency assigned. The radio equipment shall be FCC type approved and the system capable of operation on the 3KHz ot 6KHz narrow band splinter frequencies (154 or 173MHz) in the Industrial/Business radio service.

B) VHF Radio Transceiver (154Mhz or 173Mhz)

The system manufacturer shall supply a 25-watt VHF radio transceiver to insure a high level of quality and reliability. The radios shall be adjustable to 4 watts output power as may be required by the FCC for ERP (Effective Radiated Power) restrictions. All connections to the radio shall be plug-in. The VHF radio transceiver shall have the following specifications:

Transmitter:

RF output power	25 watts minimum (adjustable to 4)
Spurs & Harmonics	16 dBm (25uW) (or –50dBc)
Frequency stability	±0.00025% (-30 to +60 degrees C)
Emission	6F2 (2.5kHz DEV max) or 3F2 (1.2kHz DEV max)
FM hum and noise	-40 dB

Receiver:

Sensitivity	.35uV @ 12 dB SINAD (.5uV @ 20db quieting)
Selectivity	-65 dB
Spurious image rejection	-50 dB
Intermodulation	-65 dB
Frequency stability	±0.00025% (-30 to +60 degrees C)
Receive bandwidth	*6kHz (or 3kHz) as required to match the transmitter

* The receiver bandwidth shall be reduced to match the transmit bandwidth of the transmitter and provide a minimum adjacent channel rejection of -50db.

The radio transceivers shall be Motorola Radius SM50-M33 or DTS.

C) UHF Radio Transceiver (450Mhz)

If the system supplier can demonstrate to the satisfaction of the Engineer that no VHF (154-173 MHz) frequency can be obtained, an UHF (450-470 MHz) frequency may be used. The UHF shall operate under Part 90.35 and 90.238 for secondary fixed operations. The system will still be required to operate with point-to-point operation within the FCC rules and regulations and provide the same RF path margins as detailed in these specifications.

The UHF radios must meet or exceed the requirements set forth in these specifications for VHF radios, except that the radio output power must be adjustable to 2 watts as needed to meet FCC requirements. The radios shall be tuned to operate in 6KHz of bandwidth to meet the proposed FCC standards for 2005. Antennas shall provide a minimum 10db of gain.

No changes to the contract amount will be made for a change to UHF operation.

D) Antenna & Coaxial Cable

The radio antennas at all locations shall be a five element Yagi, constructed with 3/8" diameter solid aluminum rod elements and 1-1/16" diameter aluminum pipe element support with a type N coaxial connector. The antenna shall have a minimum 8.0db forward gain with a 20.0db front-to-back ratio. The antenna shall be wind rated for a 100-MPH wind speed. The VHF antennas shall be MC-Yagi, Decibel Products DB292, or Celwave PD390S. The UHF antennas shall be MC-Yagi or Celwave PD688S.

Antennas shall be cabled to the transmitter enclosure connection by a RG/8U low loss (less than 1.8db per 100ft @ 100MHz) coaxial cable with cellular polyethylene (foam) dielectric. The coaxial cable shall have a braided copper shield coverage of 97% and a long life weather resistant polyvinyl chloride jacket. The antenna coaxial cable connection shall be a constant impedance weatherproof Type N connector, taped with a weather resistant electrical tape to insure a lifetime watertight assembly. The coaxial cable shall be Belden 8214 or 9913 cable.

E) Antenna Lightning Protection

Coaxial connection to remote and central unit enclosures shall be by means of a coaxial type bulkhead lightning arrestor. The units shall be rated at 1 kilowatt with a minimum 500V and maximum 2000V-breakdown voltage. Coaxial lightning arrestors shall be a PD-593 or PolyPhaser IS-B50LN-C1

F) Antenna Mounting Systems

Antennas shall be mounted at a height above ground that is consistent with FCC rules and regulations and provides adequate signal fade margin as described earlier. Antennas must be a minimum of 15 feet above ground and mounted as follows:

1) **Water Towers:** The antenna shall be mounted on the ladder or the water tower catwalk railing at a height consistent with FCC requirements. The coaxial cable shall be secured to the ladder or obstruction lighting conduit. A 3/4" rigid conduit with a weather-head shall be provided from the transmitter to the ladder on the tower.

2) **Above Ground Structures:** The antenna shall be mounted on a 10' long X 1-1/2" diameter galvanized mast with top mounted weather-head. The mast assembly shall be secured to the side of the structure with Uni-strut clamps. The coaxial cable shall feed through the mast assembly to the interior of the building.

3) **Below Ground Structures:** The antenna shall be mounted on a 20' high Class II power pole with a 10' long X 1-1/2" galvanized mast secured to the side of the pole and extending 5' above the pole or a 20' high free-standing antenna tower. A 3/4" rigid conduit with a weather-head shall be provided from the below ground vault to a location 10 feet up the power pole for the coaxial cable.

4) **Antenna Towers (>20feet):** A bracketed antenna tower shall be supplied where specifically noted on the plans or in the RTU & CTU site descriptions. The tower shall be assembled from 10 sections built on a 12-1/2" (or 18" for ROHN 45G) equilateral triangle design. Tower sections shall be constructed of 1-1/4" steel tubing with continuous solid steel rod "zigzag" cross bracing electrically welded to the tubing. The entire 10' sections shall be Hot-Dip Galvanized after fabrication for long life. The antenna towers shall be ROHN Model 25G (for unsupported

heights of up to 33 feet) or ROHN Model 45G (for unsupported heights less that 45 feet).

2.04 Instrumentation & Accessories

A) General

All items in the control system (electronic cards, power supplies, radios, time delays, relays, etc.) shall be of plug- in construction, make use of a plug-in wiring harness, use plug-in terminal blocks, and be interchangeable without recalibration. To insure field repair-ability by non-technical personnel, equipment that must be un-wired for replacement will not be accepted.

The following instrumentation devices and techniques shall be used as specifically called for in the RTU and CTU input/output sections of this specification.

B) Power Supplies

The DC power supplies shall provide ±0.1% line and load regulation with ±10% input variations. They shall have a temperature coefficient of ±0.02% per degree C. The input/output isolation shall be 100 Mohms DC (900Volts AC) with output transient response of 50 microseconds maximum. The power supplies shall be sized to operate the remote unit equipment with or without the back-up battery in place. Power Supplies shall be a Power One Series MAP130, Sola SLS, or approved equal.

C) Battery Back-up Operation

The remote units indicated shall be supplied with battery back-up operation. The rechargeable batteries shall be the sealed solid gelled electrolyte types, designed for float or standby service. Unless noted otherwise in the RTU descriptions, batteries shall be sized to maintain 24-hour service at water tower remotes and 8 hour service at pump stations and other remotes. The remote shall include a charging module to recharge the battery when power is resumed, maintain the charge between outages, and provide a low voltage cut-off to protect the battery from excessive discharge during prolonged outages. All discrete, analog, and pulse inputs (i.e. switch closures, pressure, level, flows, etc.) shall continue to function on battery back up. Batteries shall be Globe Gel/Cell or approved equal.

D) Single Phase 120VAC Power Line Lightning Protection

Every site in the system shall be equipped with AC line filtering and lightning protection. The equipment shall provide 2-stage lighting/transient protection including inductive and capacitive filtering and MOV over-voltage protection.

E) Time Delays & Relays

All hardware time delays used in the system shall be of plug-in construction with DIN rail mounted sockets and have pilot duty contacts rated for 3 amps resistive @ 240VAC (or 0.8 amps inductive) loads. The time delays shall have switch selectable ranges from .1-1c, .2-10, 1.2-60, and 12-600 seconds. The time delays shall provide a ±0.2% repeat accuracy. The time delays shall have both "timing" and "timed" LED indicators. Time delays and relays shall be IDEC series GT5Y and RY4S or approved equal.

F) Level & Pressure Transducers

Level & pressure transducers shall be of the all solid-state two-wire transmitter type with a 4-20mA output from a 10.5-24VDC excitation. The units shall be powered from the RTU power supply. The transducers shall have a combined error (linearity and hysteresis) of ±0.25% full scale and be temperature compensated to ±2.5% per 100 degrees Fahrenheit. Zero and span adjustments shall be standardized so that transducers are interchangeable without recalibration. All exposed or wetted parts shall be series 316 stainless steel, PVC, or Buna-N. The units shall be capable of a three times full scale over pressure with out damage or change of calibration.

The transducers shall be mounted at the sensing point and wired to the enclosure. The transducers shall have a 1/4" or 1/2" NPT process pressure connection. Transducers for above ground mounting shall have a 1/2" conduit connection for cable entry. Transducers at water towers (and other outside locations) shall be mounted below grade and below frost line to prevent freezing. Below grade mounted units shall have factory signal cabling and be suitable for a minimum of 100' submerged duty.

Level transducers for clear-wells and wetwells shall be suspended in the clearwell or wetwell and supplied with sufficient factory installed cable to access a "clean/dry area" junction box. The suspension cable shall have a polyethylene jacket and internal venting to provide for atmospheric sensing of the non-process side of the diaphragm. The sensors shall have a multi-ported pressure-sensing end that protects the diaphragm while sensing the level of viscous liquids or slurries. The cable connection in wet-well applications shall have a non-fouling guard to prevent build up of foreign materials.

Pressure/Level transducers shall be Micro-Comm L5N series, Consolidated A300 Model 221GEE, or Ametek Model 57S.

G) Entry Alarm

Unauthorized entry alarms at remote sites shall be accomplished through a perimeter alarm system powered from the common 12VDC-power supply. The system shall include the necessary structure entrance magnetic door switches. Should an intruder enter the structure without acknowledging his presence, an entry alarm will be sent to the Central Unit. The entry alarm shall have an adjustable time delay (0-60 seconds) to allow authorized personnel time to acknowledge their presence when entering the structure and provide a re-arming delay when leaving the structure. The RTU door mounted key switch shall be constructed so that the key can only be removed in the "armed" position. The alarm system can be implemented as part of the RTU logic system or be a Digital Control Systems (DCS) or approved equal.

PART 3 – CENTRAL UNIT EQUIPMENT

The "Central Unit" shall be composed of two or more separate computers communicating over a high-speed serial data links. The first computer (called the Central Terminal Unit or CTU) shall provide all communications with remote units, local inputs and outputs, and local hardware display devices. The second computer (called the Operator Display Console or ODC) shall be responsible for the operator interface to the system and provide display, alarm, and logging of all data.

3.01 Central Terminal Unit (CTU)

A) General

The Central Terminal Unit (CTU) will be the center of control for the system. This unit shall control the system by interrogating remote units for status/alarm and level/pressure data, comparing this information to operator set points and command inputs, and generate pump commands to be sent to the remote units.

The CTU and the Operators Display Console (ODC) shall communicate with serial ASCII data communications at switch selectable baud rates up to 9600 baud. The CTU will provide to the ODC computer "on demand" all "real" status, analog, and pulse information from the remote units and "virtual" data points generated by the CTU. The CTU will receive operator input from the ODC computer and generate commands sent to the remote units.

The CTU shall be capable of supporting simultaneous access from multiple ODC computers. These ODC computers may access the CTU either locally, over a multi-drop RS-485 network, or remotely over a dial-up phone modem. The CTU shall support Allen-Bradley DF1 or Modbus communications with local /remote devices.

B) Construction

The CTU Central Processing Unit (CPU) shall be fully programmable from the ODC provide all control processing and short-term data storage for the system. The CPU shall include a combination of RAM, Flash ROM, and

EEPROM memory providing a minimum 16K of user memory. The RAM memory shall be used for temporary data storage and manipulation. The Flash ROM memory shall be used for program and configuration data storage. The EEPROM memory shall be used to store the current operating database and operator setpoints. The CPU shall include a battery backed Real Time Clock.

The CTU shall be supplied with a Win2000 XP compatible programming software that shall be installed in the ODC for use by the owner locally or the Systems Integrator via the remote access system. The CTU and programming software shall support the same feature set as detailed in the RTU specifications section.

The base CPU shall have multiple COM port(s) to support remote programming, communications with the ODC, communications with remote RTUs, and communications with local input/output devices. The ports shall support either RS232 or RS485 interfaces. COM ports shall provide LED indicators so show channel activity for TXD, RXD, and RTS. Communications with devices over cables greater than 50ft in length shall be by a RS485 multi-drop network communications. Each termination shall be accomplished via an isolated RS485 to RS232 converter that provides 750VDC of optical isolation. The CTU assembly shall be a C2000 CPU or Allen-Bradley 5/03 or 5/04 processor with Prosoft Modules added to support either Allen-Bradley DF1 or Modbus RTU protocols. The CTU shall support the following communications methods:

1) Local RS232 communications with ODCs and remote access modems.
2) Local RS485 Multi-drop Data Highway communications with local PLCs for local I/O.
3) VHF (or UHF) radio modem with remote RTUs.
4) High Speed Data Radios with remote ODCs and local I/O.

Local CTU inputs and outputs shall be accomplished via Programmable Logic Controllers (PLCs) as detailed in the Remote Terminal Unit (RTU) section of these specifications. The CTU shall communicate with local PLCs via high speed data modems or high speed data highway as detailed in the appendix of this section.

The CTU control panel shall be equipped with a battery back up. The CTU shall operate for a minimum of 8 hours controlling all radio/RTU operations. The rechargeable 12· amp hour batteries shall be sealed solid gelled electrolyte type batteries. The CTU shall recharge, maintain, and contain a low voltage cut-off protecting the battery from excessive discharge.

C) Enclosures

All of the CTU and PLC equipment (including CPU card cage, radio, power supplies, automatic antenna switching, and local inputs & outputs) at the master shall be housed in a free standing or wall mount NEMA 12 enclosure.

Refer to Appendix for specific enclosure requirements

3.02 Operator Display Console

A) General

As described previously the Central Unit shall have two microprocessors tied together with separate operating responsibilities. The first processor (Central Terminal Unit or CTU) shall handle all the telemetry, set-point comparison and command duties. The second processor (Operator Display Console or ODC) shall handle the CRT display, operator keyboard, alarm/log printer, and data storage duties.

B) System Unit

The Operator Display Console (ODC) computer shall be a Intel/Windows base processor with a Pentium IV microprocessor operating at a minimum of 2.6GHz with 1 megbit L2 cache memory and 800MHz FSB. It shall include the following features:

1) Pentium IV CPU with 1MB L2 cache memory, operating at 3.0MHz
2) 512MB of 400MHz SDRAM, expandable to 1GB
3) 80GB (minimum) Ultra ATA Hard Drive
4) 48x Read/Write CD-ROM
5) Integrated Sound Card with external speakers
6) (2) Serial Ports
7) (8) USB Ports
8) (1) Parallel Printer Port
9) QWERTY Keyboard with numeric keypad and cursor keys
10) Microsoft Mouse
11) Microsoft Windows XP Professional.

The system unit shall be housed in a desktop or mini-tower case as required by the owner. The CTU shall store all command inputs and set points as downloaded from the ODC. The hard drive in the ODC shall be used for program and data storage. The floppy disc and R/W CD-ROM shall be used for archive data storage and back-up protection of the operating program.

The separately mounted keyboard shall have a standard typewriter format with tactile feedback, twelve special function keys, and a separate numeric keypad for entering set point data and cursor control. The 256-character symbol set shall include 96 ASCII characters and the IBM (International Business Machine) graphic symbols. The system shall include an 2-button Windows compatible mouse with mouse pad. The ODC shall be a Dell Optiplex GX620 Series.

C) Display

The system unit shall be equipped with a Flat Panel display. The display shall be a 19" (diagonal, 18" viewable) high-resolution (1024 x 768) color display terminal with minimum .24mm dot pitch and IBM XVGA compatibility. The display shall be utilized for display of station and system graphics and real-time data display. The display shall provide for operator input and output data, report generation, and access to system utilities. Additionally, the display shall provide for multiple graphic overviews of the process system and/or sub-systems. The display shall be of the same manufacture as the System Unit above.

D) Printer

The system shall include a color "graphic" inkjet printer with a 600dpi black and 300dpi color resolution, 8ppm color & 5ppm black & white output speed, and 1000 page/month duty cycle. The printer shall provide for printing of alarms summaries, data logs, trend graphs, and reports. The graphic capability will be required to draw pressure, level, and flow rate graphs for each remote on command. The printer shall be interfaced to the processor via a parallel port. The printer shall be a HP DeskJet 722 printer or equal.

E) Phone-Line Debug & Remote Access Port

The Central Terminal Unit shall be equipped with a 33.6Kbps direct connect phone modem to provide long distance factory debugging over dial-up phone lines. This de-bug system shall allow the factory technician to monitor data transmissions to and from all sites, to manually send interrogations and receive data from the remote sites, and to reprogram the Central Unit CPU. The debug system shall allow testing all inputs and outputs at the "Central". The de-bug service shall provide sufficient detail to pinpoint the defective module for operator replacement. De-bug entry shall require a 4 digit access code to prohibit unauthorized access. The modem shall be universally compatible with all standard V.34, V.32bis, V.32, V.22bis, Bell 212A/V.22, V.23, V.25, and Bell 103/V.21 modems. The remote access modem shall be a US Robotics Sportster External 33.6 Faxmodem.

The ODC shall include Symantec's current version of PCAnywhere for remote access by the Owner's or Systems Integrator's remote computers.

F) Enclosures

The Operator Display Console unit (including CRT display, Keyboard, and System Unit) and the graphic printer shall be located on top of a desk supplied by the Owner. All interconnecting cabling shall be plug-in and supplied by the contractor.

G) Battery Back-up Operation

The ODC shall include 20 minutes of back up. The ODC back-up unit shall be a Stand-by Uninterruptible Power Supply (UPS) system that provides power line filtering and transient protection. The unit shall automatically take over (within 4mS) when the power line fails without interrupting or restarting the system and automatically recharge the battery within 10hours after the power returns to normal. The UPS shall be located at the desk location of the ODC and shall power the System Unit, CRT display, and printer. The UPS shall be a APC Back-UPS 650, 1000, or 1400 as required.

3.03 Operator Display Console Software

A) General

The software shall be 32bit compatible and capable of operating in the ODC hardware described above as well as in customer supplied Win XP compatible hardware with XVGA display, 440MB hard drive of hard drive space and 128MB of RAM memory. The contractor shall supply a fully functional "developmental" version of the SCADA software (including any required software protection keys) for the first ODC as well as a separate configured "runtime" version for installation and use in a customer supplied back-up computer. The software may be modular, however the operator interface shall provide an integrated interface to all areas of the program. Demo program copies will not be allowed.

The software shall operate in the 32-bit Windows XP Professional environment and be fully Y2K compliant. The software shall be the latest "full developmental" version of SCADAview32, Wonderware InTouch, Intellution FIX-DMACS, or Allen-Bradley RSView32. The software shall be licensed to the owner.

A phone dialer software program shall be supplied and configured for this project. The software will utilize a voice modem and dial pre-programmed phone numbers in the event of an alarm. The alarms can be grouped into three different categories allowing a maximum of 8 phone numbers per category. The software and voice modem shall indicate (by voice) the condition and location of the alarm. The software shall perform similar to a hardwired phone dialer and include such features as pager dialing, call back acknowledge-ment, adjustable delay between calls, etc. The dialer software shall be SCADAdial 32.

B) System Back-up & Installation

The contractor shall provide a back-up copy of the installed software on a CD-ROM disk. Back-up copies of any setup or graphic files shall be on a CD-ROM. The copies shall be kept by the Owner for emergency reloading in the event of a catastrophic failure. The contractor shall provide an easy to use installation (or re-installation) program that will automatically setup the hard drive operating system and automatically load (or reload) the software.

C) System Restart

The software shall automatically restart in the event of a power failure. All data necessary for the operation of the system shall be reloaded from mass memory (hard drive). To minimize the restart procedure, a copy of the current state of the following data shall be stored in mass memory:

1) Status Points
2) Measurement Points
3) Calculated Points
4) Pseudo points
5) Accumulator points
6) Date and Time
7) Current limits

D) System Capacity

At a minimum, the operating software shall be capable of accommodating 32,000 tag points as follows:

1) Discrete status & alarm points
2) Measured variables
3) Accumulated variables
4) Calculated status & alarm points
5) Calculated control points
6) Operator consoles
7) Remote Operator Console
8) Printer for each console

E) Operator's Console

In general, the operating software shall display all received data in engineering units with operator generated labels, generate and print alarms, print logs, store manually entered data, update CRT displays, and perform operator commanded functions as required by the database. The system shall automatically generate the following system displays:

1) Main Menu page (with direct access to all screens and other program modules)
2) System Summary page listing key data points for all RTUs in the system
3) RTU specific display pages showing all data for each RTU in the system

Beyond the basic operating software required for SCADA operations, the software package shall accommodate the following:

Analog Data:

a) Display value directly in engineering units
b) Accept operator High & Low alarm limits and generate alarms
c) Accept operator rate of change alarm limit and generate alarm
d) Store data for trending displays

Flow Rate Data:

a) Display value directly in engineering units
b) Accept operator High & Low rate alarm limits and generate alarms
c) Totalize flow total and display in engineering units
d) Accept operator High/Low 24 hour total limits and alarms
e) Store data for trending displays

Pump Control Operations:

a) Display ODC, CTU, and RTU HAND/OFF/AUTO functions
b) Display Pump CALL/RUN/FAIL status for each pump
c) Input/Display control database

Status Point Operations:

a) Display ODC, CTU, and RTU status functions
b) Input/Display control database

Alarm Point Operations:

a) Display ODC, CTU, and RTU alarm functions
b) Enter new alarm in data log archive and send alarm to printer
c) Sound alarm horn until alarm is acknowledge by the operator
d) Log alarm acknowledgment to data log and printer
e) Log alarm clearing and send alarm clear to printer
f) Input/Display control database

Event Point Operations:

a) Display ODC, CTU, and RTU alarm functions
b) Display ODC, CTU, and RTU event functions
c) Enter new event in data log archive and send alarm to printer
d) Log event clearing and send alarm clear to printer
e) Input/Display control database

F) Database Editor

The Database Editor shall be an on-line operating software system for the generation and modification of the ODC display database for the system. The integrator shall generate the initial database for the SCADA System, including the graphics displays. It shall be possible to perform the editing function while the system continues to poll remotes for data and performs its normal SCADA control functions. The editor shall operate in an English language type conversational mode and shall not require an understanding of programming as a prerequisite for its use or modification. All data displays of the measurement point shall be color designated based on which limit has been violated (e.g., green-normal, red-emergency, etc.). The editor shall allow for the creation and modification of text and graphic displays pages. At a minimum, the following editors shall be available to create or modify the database:

1) **RTU and Station Editor**
   a) Add, delete, or modify RTU displays.
   b) Modify individual RTU displays including renaming or re-scaling existing points and adding and defining new data points, .

2) **Status Point Definition Editor**
   a) Add, delete or modify individual points including the following specific characteristics:
   b) Status points logic
   c) Point and Station name
   d) Alarm conditions
   e) Normal state
   f) Designation of multiple status points associated with a single control point to allow for verification of proper operation

3) **Measurement points**
   a) Point and Station name
   b) Scaling factors
   c) Rate of change limit
   d) High/Low alarm limits
   e) Normal Condition

The editor will allow for the entry of the following type of information:

4) **Text Display Pages:**
   a) Alphanumeric, line and special functional characters for Text Displays
   b) Status/Control points (On/off/alarm display)
   c) Foreground/Background color selection

5) **Custom Pixel Level Graphic Displays**
   a) Modifying existing and adding new graphics. The graphics development system shall include predefined symbols, allow the operator to generate custom symbols, and provide for importing third party bmp graphics. The status of the equipment shall be indicated by the color of the symbol shown on the display. The following colors shall be used consistently in all displays to indicate the status of equipment:

Pumps:	Called For	- Yellow
	Running	- Green
	Off	- Black
	Failed	- Red
	Signal Loss	- Gray (out of service)
Alarms:	High Level	- Red
	Low level	- Blue
	Signal Loss	- Gray (out of service)

b) Digital Display Windows with control of :
   1. Numerical format
   2. Special display scaling

c) Analog Bar graph Display Windows with control of:
   1. Width
   2. Height
   3. Display range
   4. Text strings

6) As a consequence of the database entry and normal system operation, the system software shall generate the following CRT pages:
   1. Active alarm summary page
   2. Alarm/event history summaries

7) The contractor shall generate a custom graphic display to for each control grouping in the system. For example a graphic display will be required for each tower/pump station combination in the system.

8) The system shall provide for password protection to any desired area of the system. Each operator shall be assigned a unique password to control his access. At a minimum, the system shall be capable of limiting access to certain user-designated areas:
   a) Engineering Level – access to system setup parameters
   b) Supervisory Level – access to start/stop and high/low alarm settings
   c) Operator Level – access to HAND/OFF/AUTO controls

G) Real-time Graphic Displays

The system shall include real-time custom graphic displays. The graphic displays shall be pixel level graphics with full control of the 1024x768 pixel resolution and 16 bit color capabilities of the CRT display.

H) Data Archiving

The program shall track all of the activity in the system. The program shall take a snapshot of all of the active data in the system every 6 minutes and store this data to the hard drive. The archive data shall be organized by in to monthly files for each RTU. At the end of the month, the operator shall be prompted to move the archived data from the hard drive to floppy disks. The data archiving shall be automatic and employ data compression to allow 1 month of stored data for up to 4 RTUs to be stored on a floppy disk. The data shall be directly usable by the system in its compressed form from either the hard disk or floppy disk storage media.

I) Automatic Logging

The system shall automatically log all alarm and event activities (i.e. occurrence, acknowledgement, and clearing) and operator changes to the system. This logging shall be to a monthly file on the hard drive. In addition to the event and alarm log the system shall provide operator selected data logs as follows:

1) Hourly Logs
2) Daily Logs

J) Historical Data Trending Module

The Central Unit shall generate historical data files, stored in available space in the system mass memory. All data is to be accumulated on the hard disk until moved by operator command to the floppy disk storage (ASCII format). Data stored on the floppies shall be capable of being reread directly from the floppies into the system for report generation with out disturbing the current database.

K) Trend Graph Module

This module shall allow the user to output up to 8 data points stored in historical files in trend graph form on the CRT and/or to the printer. These graphs shall be generated by the entry of the following information:

a) Graph type selection (single pen or 8 pen)
b) Historical data set to be used
c) Names of points to be displayed (up to eight different points)
d) Start date selection

L) Historical Report Generator Module

The system shall include a Historical Report Generator module that allows for operator selected data to be pulled from the archived database and converted to an ASCII, comma delimited file format. The format shall allow for data import into other software packages for data review by the Owner or his engineer. The data search shall allow for 1 to 365 days of accumulated data.

PART 4 - REMOTE TERMINAL UNIT & LOCAL I/O EQUIPMENT

A) General

The Remote Terminal Units (RTUs) shall be "smart" Programmable Logic Control (PLC) units at all locations. The core software program used at all locations shall be identical and stored in non-volatile FLASH type ROM memories that can be upgraded in the field by the owner using configuration software supplied as part of this contract. The core RTU software shall provide the basic operational logic including communication with other sites in the system, responding to control commands from the CTU, and providing back-up peer-to-peer control in the event of a CTU failure. The RTUs shall be M1500, S4500, or Allen-Bradley Micro-Logix 1500 units with LRP series processor.

Program and configuration data shall normally be stored in battery-backed or flash type memory for use by the CPU. In addition, this data shall also be stored in a plug-in operator interchangeable EEPROM memory module. This module shall be fully enclosed with no exposed electrical leads, similar to the Allen-Bradley MM1 memory module, providing protection against damage due to handling and static electricity. The module shall be programmed via the CPU and without the use of external adapters. The RTUs shall include

"watch-dog" circuitry and be "self-initializing" without operator intervention. In the event that the program or configuration data is corrupted, the CPU shall reload the program and configuration data from the EEPROM memory module.

The RTUs shall be fully online programmable while the RTU continues to communicate with the rest of the system and performs its assigned control tasks. The RTUs shall support "fill-in-the-blank" type configuration for basic operation and to set-up common features such as COM port set-up, peer-to-peer data collections, local back-up control set points, input and output setup, output on/off time delay settings, front panel display setup, etc. The RTU shall also support a process script language or ladder logic type programming for site-specific customizations including special input and output manipulations, local sequential control, math functions, and PID control as follows:

Relay (Bit) Type	- Examine if ON, Examine if OFF
Timer & Counter	- Timer ON, Timer OFF, Timer DONE
Compare Functions	- Equal, Not Equal, Greater Than, Less Than, etc
Math Functions	- Add, Subtract, Multiply, Divide, Square Root
Scaling Functions	- Scale & Scale with Parameters
Logical Functions	- AND, OR, & NOT
Program Control	- Jump & Skip Next functions
PID	- PID with compound loop input

The RTU/PLC programming software shall be written for the 32 bit interface of Win98/NT/2000. The supplier shall provide a licensed copy of the RTU configuration and programming software along with the necessary communications cables to the owner. Training on the use of the software shall be provided as part of the system training.

B) Construction

The RTU shall use modular construction. The base unit shall be composed of the power supply, CPU, communications modules, and basic inputs and outputs. The unit shall have expandable inputs and outputs via either a card rack design or integrated high-performance serial I/O bus. All terminations on the RTU or expanded I/O shall use removable, NEMA-style "finger-safe" terminal blocks on the controller and I/O.

The RTU shall be capable of being powered from AC, DC, or solar sources. DC and solar powered RTUs shall have an integral battery charging circuit that protects the external battery from over and under voltage conditions and provides automatic charging of the battery after power failures. The back-up power supply shall be either 12VDC with 24VDC DC/DC convertor or 24VDC with a 12VDC DC/DC convertor to run the 12VDC radio and 24VDC to power external sensors from a single battery source. Series tapped 24VDC batteries for 12VDC will not be allowed. Back-up batteries shall be rechargeable sealed lead-acid type batteries as manufactured by PowerSonic or equal. The back-up battery shall provide for 24 hours of back-up operation at water tower remote units and 3 hours at all other sites.

The RTU shall have a minimum of two (2) communications ports. The first shall be used primarily for CTU-RTU and RTU-RTU communications. It shall support baud rates of 110-19,200 baud and have a plug-in standard 25pin or 9pin sub-D connector that provides both full RS232 interface and radio modem interface for use with either "data" radios or standard business band type radios (i.e. radios with out internal modems). This port shall also have a 9 pin sub-D connector to allow monitoring of the communications activity. The second communications port shall provide for multi-drop type communications with operator interfaces, external inputs and outputs (I/O), and programming terminals. The port shall provide for both 2 and 4 wire RS485 interface with data rates to 9600 baud. The communications ports shall include LED's to show the status of all control lines.

The RTU shall provide for sufficient installed and configured spare inputs and outputs (I/O) to meet the site requirements as detailed and provide for 25% spares of each type. The unit shall have a minimum of (4) discrete (relay) outputs, (8) discrete inputs (DI), (4) analog inputs (AI), and (1) high speed pulse input (PI). The analog and pulse inputs shall provide for sensor excitation with separate fuses for each input. The fuses may be the self-resetting type. All input and output connections to the RTU shall be via Nema "finger-safe" plug-in terminal blocks. The RTU inputs, outputs, and operator interface shall be as follows:

1) **Discrete Outputs** - The discrete outputs shall be isolated relay outputs rated at 5.0A continuous @ 240VAC. LEDs on the front of the RTU base unit or expansion module shall indicate the status of each output point. Interposing relays shall be provided if the voltage or current of the external load on a contact exceed the 5.0A 240VAC ratings. Each output shall be provided with operator settable software ON and OFF time delays

2) **Discrete Inputs** - The discrete inputs shall be optically isolated and provide for 24VDC excitation to remote sensors and switches. Each input shall be separately fused or current limited such that accidental grounding shall not render the other inputs non-functional. LEDs on the front of the input module shall indicate the status of each input point.

3) **Analog Inputs** - The analog inputs shall provide filtered and scalable analog to digital conversion of input signals. The analog inputs shall be switch selectable from 0-5VDC to 0-20mADC and provide a minimum of 0.3% resolution and 0.5% accuracy over the temperature range of 0-70degrees C. The RTU shall provide separately fused 24VDC excitations to the remote sensors.

4) **Analog Outputs** - The analog inputs shall provide a 0-5VDC signal to RTU panel mounted devices or 4-20mA isolated signals if sent to other panels as specified.

5) **Pulse Inputs** - The high-speed counter/pulse inputs shall provide for pulse rates up to 1KHz direct from flow meter transmitter heads without interposing equipment. The pulse input shall include fused 12VDC excitation to the meter transmitter.

6) **Power Supply** - Each RTU assembly shall include an integral power supply. Power supplies shall be designed for 12VDC or 24VDC input power and suitable for use in battery back-up operations. DC/DC converters shall be required to insure that both the 12VDC and 24VDC are regulated separately from the common source.

7) **Keypad & Display Unit** - The optional keypad & display unit shall have a 4x20 back-lighted LCD display to display the status of all local inputs and the tank level of the associated control water tower level. The 5x5 keypad shall provide for operator input of set points and timer settings. The operator interface shall be menu driven and provide for dedicated keys for cursor position and input functions. The operator interface shall provide for up to 50 screens of data display. The keypad & display unit shall be supplied and mounted on the front of the RTU enclosure if detailed in the specific RTU I/O requirement list. The keypad & display unit shall maintain the Nema 4 rating of the RTU enclosure.

C) **Enclosures**

The remote unit enclosures for indoor mounting shall meet all the requirements for NEMA Type 12 enclosures. The enclosures body shall be made of a minimum 14 gauge steel with continuously welded seems and be furnished with external mounting feet. The enclosure door shall be made of a minimum 16 gauge steel with have a 14 gauge steel hinge. Enclosures larger than 16x14 shall have a rolled lip on 3 sides of the door for added strength. The door opening shall have a rolled edge on 4 sides to protect the door gasket. The door gasket shall be heavy neoprene and attached to the door with oil resistant adhesive. Sub-panels shall be 14-gauge steel for 16x14 enclosures and 12 gauge for larger enclosures. The enclosure finish shall be gray polyester powder coating inside and out over phosphatized surfaces. The subpanels shall be finished in white. Nema 12 enclosures shall be Hoffman "CH" or "CONCEPT" wall mount enclosures.

Remote site installations requiring equipment to be mounted outside shall have a double box enclosure with the remote unit enclosure mounted inside a lockable NEMA 3R enclosure. The double enclosure shall be required to control vandalism, provide complete weather protection, reduce the heating effects of the sun, and prolong the life of the equipment. The NEMA 3R enclosure shall be constructed of 14 gauge galvanized steel, with a drip shield top and seems free sides front and back, and a stainless steel hinge pin. The enclosure finish shall be gray polyester powder coating inside and out over phosphatized surfaces. The NEMA 3R enclosure shall be Hoffman Bulletin A-3.

The remote unit enclosures mounted in damp corrosive areas (such as concrete meter vaults) shall be NEMA Type 4X rated enclosures. The enclosures shall be made of molded fiberglass polyester and be furnished with external mounting feet. The door shall have a seamless foam-in-place gasket and corrosion-resistant hinge pin and bails. Sub-panels shall be 14-gauge steel for 16x14 enclosures and 12 gauge for larger enclosures. The enclosure finish shall be a light gray inside and out. The subpanels shall be finished in white. Nema 4X enclosures shall be Hoffman "Fiberglass Hinged Cover".

Refer to Appendix for specific enclosure requirements.

D) Local Control Functions

In general the RTU shall be programmed to provide generic control functions as detailed earlier and to work in concert with the CTU. The integrator shall be responsible to meet with the owner and the engineer to develop the automatic control strategy required for the system.

Refer to Appendix for special input and output control requirements.

PART 5 - EXECUTION

5.01 Equipment Examination

The control system shall be completely tested prior to shipment. The entire control system shall be "Burned In" at the factory for a period of at least 20 days. The component equipment shall be computer tested and temperature cycled at zero degrees and at fifty degrees centigrade.

5.02 System Start Up

The manufacturer shall supply "Factory" personnel for start-up service as needed to insure satisfactory operation. Subsequent trips to the job site to correct defects shall be made at no charge to the Owner during the warranty period.

5.03 Training

The system manufacturer shall supply "factory" personnel to conduct two separate on-site training sessions, totaling a minimum of three days of training.

The initial training session shall be conducted during start-up as needed until the Owner and Engineer are satisfied that the operators are comfortable with the operation and maintenance of the system. Training shall be done on site with the owner's personnel.

Three to six months after the Owner commencing system operation, the system manufacturer shall supply "factory" personnel to conduct follow-up training of the Owner's personnel. The follow-up training shall be conducted on-site and consist of reviewing the operation and maintenance of the system. The Owner shall be contacted a minimum of two weeks in advance, prior to scheduling the training session to allow proper coordination.

5.04 Substantial Completion

The Engineer will grant substantial completion only after completion of the start-up and initial training phase of the project. The Engineer shall make an inspection of the system to determine the status of completion. Substantial completion will be awarded only when the system is providing usable service to the Owner. If the system is commissioned in phases, the Contractor may request substantial completion for the completed phases.

5.05 Acceptance Test

After start-up and debugging of the entire system has been completed, the system manufacturer shall notify the Engineer that he is ready to begin the 60-day acceptance test. The system must run continuously for 60 consecutive calendar days. During this period, all system functions shall be exercised in automatic control, including all levels of back-up control. During the initial phase of the acceptance test, the multiple levels of control and radio path pad shall be demonstrated to the Owner as follows:

1) Primary level control shall be demonstrated by allowing the operators to manually initiate remote device operation and observing the automatic operation by comparing trend charts to operator entered stop/start values.

2) Secondary level control shall be demonstrated by turning off the ODC and verifying that each automatic control loop continues to function by monitoring operation with a passive monitor.

3) Third level control shall be demonstrated by turning off the CTU radio and verifying that the RTUs continue automatic operation and communications between RTUs by monitoring one full cycle of automatic operation using a passive monitor.

4) The fourth level of control shall be demonstrated by placing selected RTUs in back-up pressure mode and monitoring tower levels to observe one full pumping cycle.

Any level test or system interruption and accompanying component, subsystem, or program failure shall be logged for cause of failure, as well as the time of occurrence and the duration of each failure.

The Owner's representative shall classify failures as either major or minor. A minor failure would be a small, non-critical component failure that is corrected by the operators. This occurrence shall be logged but shall not be grounds for non-acceptance unless the same or similar failure occurs repeatedly (more than two such failures of similar components). A major failure shall be considered to have occurred when a component, subsystem, or program fault causes a halt in the operation of the any portion of the system and/or when a "factory" technician's work is required to make a repair or to reinitiate operation of the system.

A major failure shall cause termination of the 60-day acceptance test. When the causes of a major failure have been corrected, a new 60-day acceptance test shall be started. Final Acceptance of the control system shall not occur until satisfactory completion of this 60-day test.

The manufacturer shall provide "factory" personnel who shall be on site and conduct the initial system exercise portion of the testing. The manufacturer shall be responsible for maintaining a checklist type test report wherein each function is checked-off and initialed by the Owner's representative as it is demonstrated. During the remainder of the 60-day acceptance test, the manufacturer shall provide 24-hour response to calls from the owner in order to correct any failure.

5.06 Warranty/Support Program

The control system manufacturer shall supply a **five (5)** year parts and labor warranty and comprehensive support program for all items and software supplied under this section (except as noted below). Power surges and lightning damage shall be included as part of the warranty.

The warranty shall begin from the time of "substantial completion" as issued by the engineer. The manufacturer shall provide a 24-hour response to calls from the Owner. The manufacturer, at his discretion, may dispatch replacement parts to the Owner by next-day delivery service for field replacement by the Owner. Any damage to the control system caused by the actions of the Owner in attempting these field replacements shall be the sole responsibility of the manufacturer. If, during the warranty period, satisfactory field repair cannot be attained by field replacement of parts by the Owner, the manufacturer shall dispatch "factory" personnel to the job site to complete repairs at no cost to the Owner.

The support program shall begin from the time of "substantial completion" as issued by the engineer. The support program shall include free updating of all software as needed and providing free phone support from the integrator throughout the warranty period.

The ODC Computer System Unit, keyboard, CRT display, printer, and associated UPS (and Portable Operator Display Console if specified in this contract) shall be covered by a one (1) year warranty beginning with "substantial completion". Lightning damage shall be included as part of the warranty on these components.

PART 6 – APPENDIX: DETAILED EQUIPMENT DESCRIPTION

6.01 Central Unit Requirements

A) Installation Requirements:

All of the Central Terminal Unit equipment (including CTU, radio, power supplies, and local inputs & outputs) at the central shall be housed in a NEMA 12 enclosure. The owner will provide the ODC computer desk, chair, and cabinets. The owner will provide an access to phone line and/or high-speed Internet connection.

The antenna shall be mounted on a 10' long X 1-1/2" diameter mast secured to the side of the building at a minimum of 20'. The antenna and coax shall be routed as close as possible to the CTU panel.

B) CTU Communications Method:
The CTU shall communicate with remote units via licensed radio frequencies, as specified earlier. The Systems Integrator shall provide the communications hardware to make a complete radio based wide area (data) network. The CTU shall interface with the ODC desktop computer system and provide back-up capabilities in the event of computer failure, as specified earlier.

6.02 Water Tower Remote Unit Requirements

A) Installation Requirements:

The remote units shall be located at the following tank sites: **KY 33 Tank, Mortonsville Tank, and Cummins Ferry Tank.**

The tower transceiver NEMA 12 enclosure shall be mounted inside a vented, lockable, NEMA 3R enclosure as specified.

The level transducer shall be a two-wire transmitter suitable for below ground mounting as specified earlier. The level transducer shall be installed in the existing pressure panel. The pressure panel shall be modified and cleaned up. The existing Rosemont transmitter shall be giving to the owner for spare parts. The pressure connection shall be equipped with a corporation stop providing a 1/4" NPT female connection for the transducer.

The antenna shall be as specified and mounted on the water tank at a height consistent with FCC requirements. The owner/electrician shall provide a 3/4" rigid conduit with a weather-head from the transmitter to the ladder on the tower.

B) CTU Communications Method:
The CTU shall communicate with these RTUs via VHF/UHF radio communications as detailed previously.

C) Front Panel Display Requirements:
1) Front Panel LCD Display

D) Discrete Outputs:
1) FUTURE Altitude Valve Control (if available/interface to valve controller)
2) Telemetry Control (displayed on front of RTU assembly)

E) Discrete Inputs:
1) FUTURE Altitude Valve Open (if available/interface to valve controller)
2) FUTURE Altitude Valve Closed (if available/interface to valve controller)
3) FUTURE Valve pit Flooding (if available)
4) Power Failure
5) –8) spares

F) Analog Inputs:

1) Water Tower Level (suppressed head data from new transducer)
2) –4) spares

6.03 Booster Pump Station Requirements

A) Installation Requirements:

The remote units shall be located at the following locations: **KY 33 and Cummins Ferry Pump Stations.**

Telemetry Control and Pump Command outputs to other panels shall be dry isolated contacts on relays. Indicating lamps shall display the status of these outputs on the front of the enclosure.

Local pressure inputs shall be by two-wire transducers as specified with the transducer located at the sensing point. Flow rate and totalizing shall be as specified above.

General Contractor/electrician shall install all instrumentation, conduit, and wiring.

The RTU equipment shall be housed in a NEMA 12 enclosure. The RTU equipment shall include an internal power switch, bulkhead coaxial cable lightning arrestor, and a power line lightning arrestor as specified earlier.

The antenna shall be mounted on a 10' long X 1-1/2" diameter mast secured to the side of the structure as previously specified.

B) CTU Communications Method:

The CTU shall communicate with these RTUs via VHF/UHF radio communications as detailed previously.

C) Front Panel Display Requirements:

1) Keypad & Display assembly to display all inputs and output status.

D) Discrete Outputs:

1) Telemetry Control (displayed on front of RTU assembly)
2) Booster Pump #1 CALL
3) Booster Pump #2 CALL

E) Discrete Inputs:

1) Power Failure
2) Booster Pump #1 RUNNING
3) Booster Pump #2 RUNNING
4) Low Suction Pressure (From existing MCC or Pressure Switch)
5) Un-authorized Entry (new door switch)
6) – 8) spares

F) Analog Inputs:

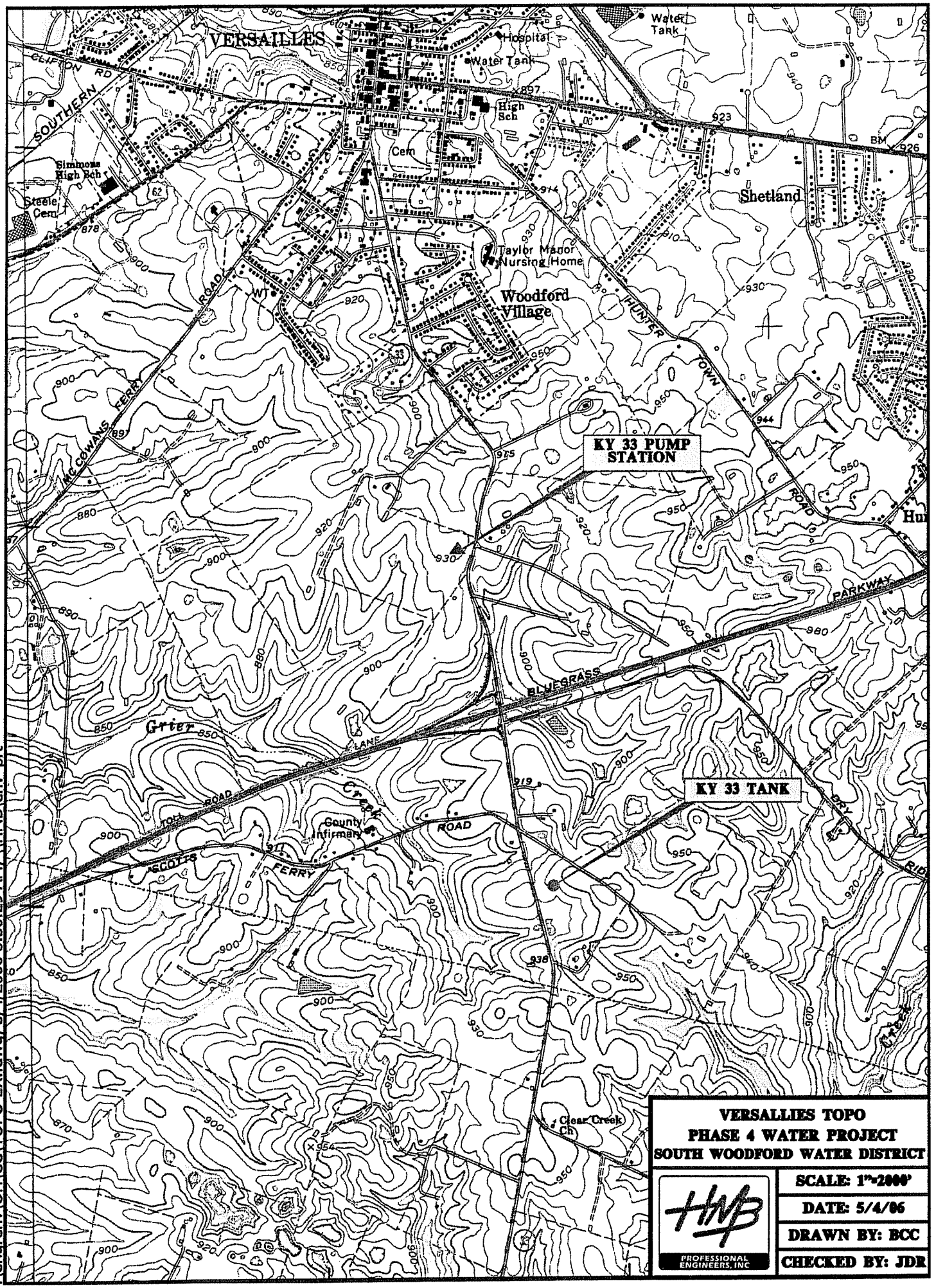
1) Discharge Pressure Indication
2) Suction Pressure Indication
3) – 4) spares

G) Pulse Inputs:

Flow Rate & Total (From existing Flow Meter or owner supplied meter).

APPENDIX A

LOCATION MAPS



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HMB PROFESSIONAL ENGINEERS, INC

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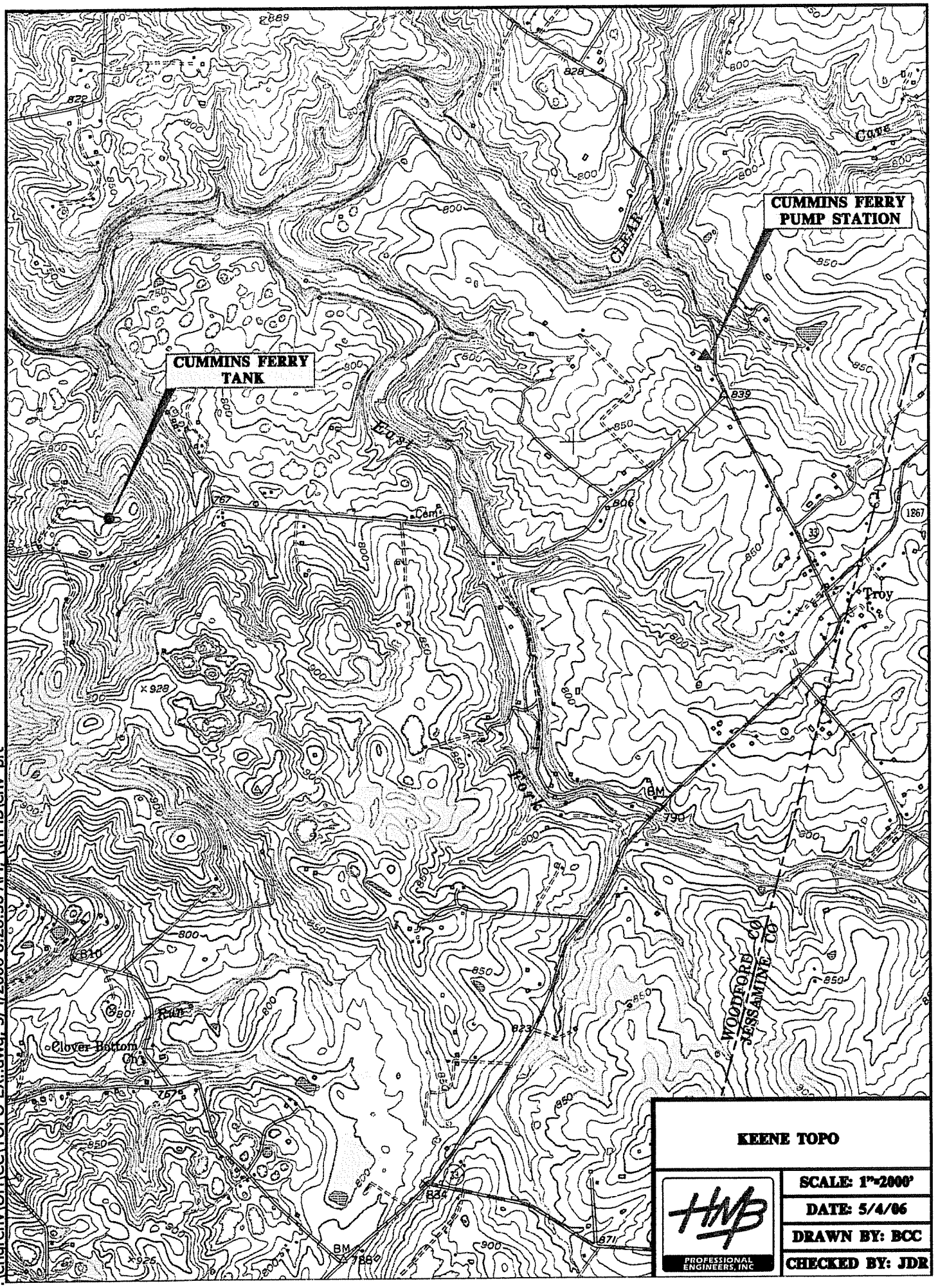

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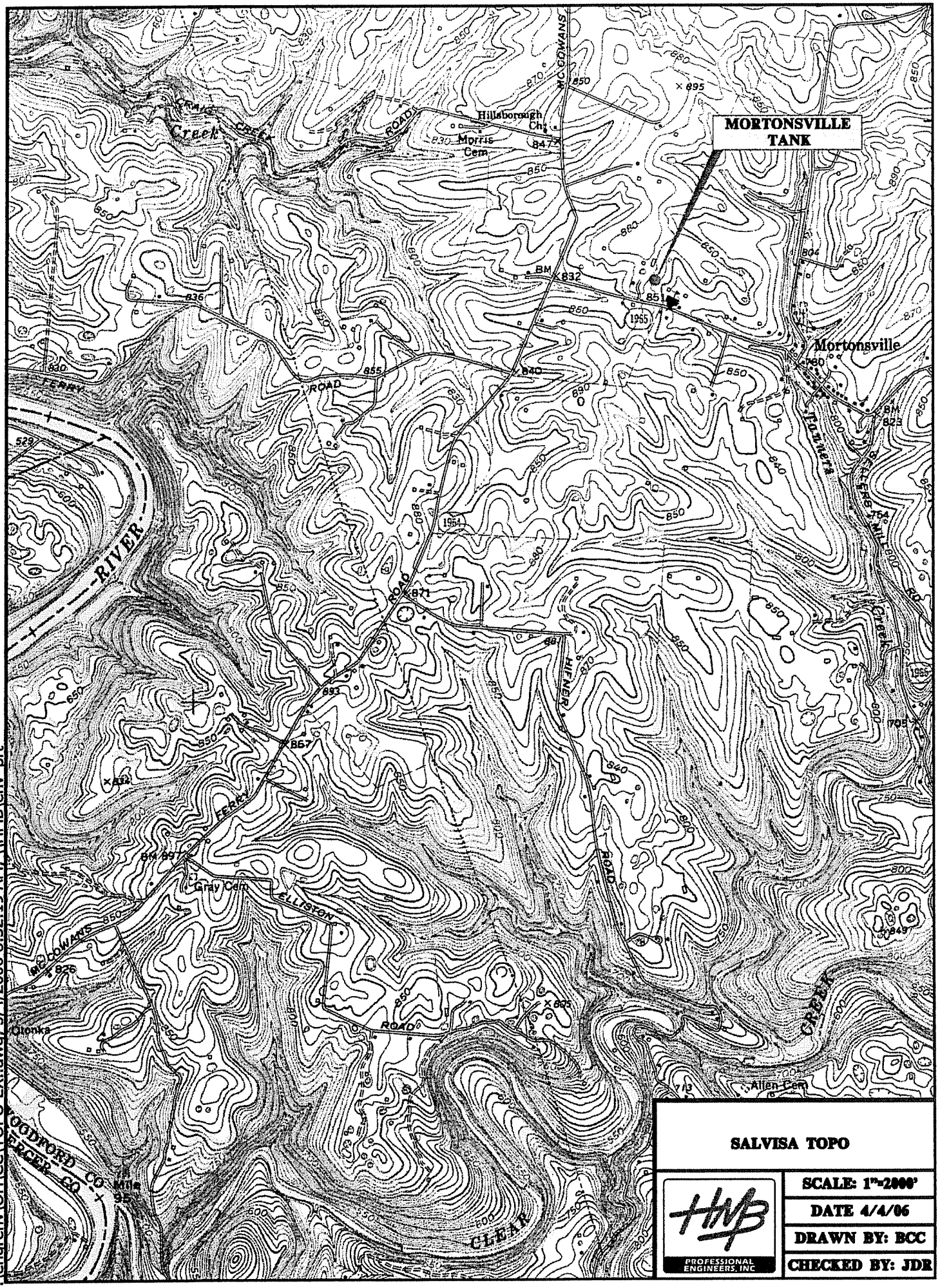

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SCALE: 1"=2000'	
DATE 4/4/06	
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HMB PROFESSIONAL ENGINEERS, INC

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CONTRACT III
SCADA SYSTEM
PHASE IV WATER PROJECT
SOUTH WOODFORD WATER DISTRICT
WOODFORD COUNTY, KENTUCKY
OCTOBER 2006

Proposal of_____(hereinafter called "BIDDER"), organized and existing under the laws of the State of doing business as_____.* To the_____ _____(hereinafter called "OWNER").

In compliance with your Advertisement for Bids, BIDDER hereby proposes to perform all work for the construction of South Woodford Water Water District, Phase IV Water Project (Contract III) in strict accordance with the Contract Documents, within the time set forth therein, and at the prices stated below.

By submission of this bid, each BIDDER certifies, and in the case of a joint bid each party thereto certifies as to its own organization, that this bid has been arrived at independently, without consultation, communication, or agreement as to any matter relating to this bid with any other BIDDER or with any competitor.

BIDDER hereby agrees to commence work under this contract on or before a date to be specified in the Notice to Proceed and to fully complete the project within 180 consecutive calendar days thereafter. BIDDER further agrees to pay as liquidated damages, the sum of $500.00 for each consecutive calendar day that the work remains incomplete after the expiration date of the contract.

BIDDER acknowledges receipt of the following Addenda:

Addendum No._____ Addendum No._____ Addendum No.

The BIDDER hereby proposes to furnish and do all that is required by the contract to which this refers for the construction of all structures listed at the prices shown for each bid item on the following Bid Schedule. (The Bid Schedule attached lists the various divisions of construction contemplated in the Plans and Specifications, together with an estimate of the units of each. With these units as the basis, the BIDDER will extend each item, using the cost he inserts in the unit column. Any total cost found inconsistent with the unit cost when the bids are examined will be deemed in error and corrected to agree with the unit cost which shall be considered correct).

*Insert "a corporation", "a partnership", or "an individual" as applicable.

The undersigned BIDDER does hereby declare and stipulate that this proposal is made in pursuance of and subject to all terms and conditions of the Instructions to Bidders, the Construction Contract, the Technical Specifications, and the Plans pertaining to the work to be done, all of which have been examined by the undersigned.

Accompanying this proposal is a certified check or standard bid bond (5% of the Total Bid) in the sum of _____ dollars and cents ($_____) in accordance with the Instructions to Bidders.

The undersigned BIDDER agrees to execute the contract and Performance and Payment Bond for the amount of the total of this bid within 10 calendar days from the date when the written Notice of Award of the contract is delivered to him at the address given in this proposal. The name and address of the corporate surety with which the BIDDER proposes to furnish the specified Performance and Payment Bond is as follows: _____

_____

_____

_____

All the various phases of work enumerated in the Technical Specifications with their individual jobs and overhead, whether specifically mentioned, included by implication or appurtenant thereto, are to be performed by the Contractor under one of the items listed in the Bid Schedule, irrespective of whether it is named in said list.

Payment for work performed will be in accordance with the Bid Schedule, subject to changes as provided for the Construction Contract.

The BIDDER understands that the OWNER reserves the right to reject any or all bids and to waive any informalities in the bidding.

The BIDDER agrees that this bid shall be good and may not be withdrawn for a period of 90 calendar days after the scheduled closing time for receiving bids.

Bids shall include sales tax and all other applicable taxes and fees.

BID SCHEDULE

Furnish, install and place into operation a completely integrated all solid-state radio telemetry base Supervisory Control and Data Acquisition (SCADA) System.

The total lump sum bid shall be written both in words and numerically. In case of a discrepancy, amount shown in words will govern. THE BIDDER'S TO TAL LUMP SUM BID IS:

_____ DOLLARS AND

_____ CENTS ($ _____)

The above prices shall include all labor, materials, bailing, shoring, removal, overhead, profit, insurance, etc., to cover the finished work of the several kinds called for complete in place.

_____

(Contractor) (Date)

By_____

_____

(Title)

_____

(Business Address)

_____

(Phone Number)

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned _____

_____ as Principal, and _____

as Surety, are hereby held and firmly bound unto _____

_____ as OWNER in the penal sum

of _____for the payment of which, well

and truly to be made, we hereby jointly and severally bind ourselves, successors and assigns.

Signed, this _____ day of _____, 20 _____.

The Condition of the above obligation is such that whereas the Principal has submitted to

_____

a certain BID, attached hereto and hereby made a part hereof to enter into a contract in

writing, for the_____

_____

NOW, THEREFORE,

(a) If said BID shall be rejected, or

(b) If said BID shall be accepted and the Principal shall execute and deliver a contract in the Form of Contract attachment hereto (properly completed in accordance with said BID) and shall furnish a BOND for faithful performance of said contract, and for the payment of all persons performing labor, furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said BID, then this obligation shall be void, otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its BOND shall be in no way impaired or affected by any extension of the time within which the OWNER may accept such BID; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set forth above.

_____(L.S.)
Principal

_____
Surety

By: _____

IMPORTANT - Surety companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state where the project is located.