CONTRACT FOR SERVICES
CITY OF BISBEE
PROJECT NO. CW 013-2013A
SAN JOSE WWTP PHOTOVOLTAIC (PV) SOLAR POWER GENERATION SYSTEM

THIS AGREEMENT, made this **18th** day of **June 2014**, by and between **Performance Contracting, Inc.** hereinafter called the "Contractor", and the **City of Bisbee,** Arizona, hereinafter called the "Owner":

W I T N E S E T H:

That the Contractor and the Owner agree as follows:

ARTICLE 1 - SCOPE OF WORK

As required by the Contract Documents, the Contractor shall completely furnish and install all of the materials and labor and perform all of the work in a good, workmanlike and substantial manner and to the satisfaction of the Owner for the Owner's Project known as the **San Jose WWTP Photovoltaic (PV) Solar Power Generation System.**

The Contractor shall be under the direction and supervision of the City Engineer, or his properly authorized agents, and strictly pursuant to and in conformity with the Drawings and Specifications prepared by **Pacific Advanced Civil Engineering, Inc. (PACE)** for the Owner, and with such modifications of the same and other documents that may be made by the Owner, through the City Engineer or his properly authorized agents, as provided herein.

ARTICLE 2 - THE CONTRACT DOCUMENTS

The following listed documents constitute the Contract Documents, and they are all as full a part of the Contract and General Conditions as if herein repeated:

This Contract and General Conditions between Owner and Contractor
WIFA Contract Package
Contract Bond
Labor & Material Payment Bond
Change Order Request Form
Contract Certification of Completion and Expressed Warranties
Unconditional Waiver
Conditional Waiver
Contractor's Bid Proposal
- Bid Form
- Receipt of Addendum
- Bid Bond
- Non-Collusion Affidavit

Project Technical Specifications

Drawings to this Contract (under separate cover)

In the event of any conflict in the provision of these Contract Documents, these respective documents shall prevail in the order listed.

ARTICLE 3 - CONTRACT AMOUNT

3.1 CONTRACT AMOUNT. **The Owner shall pay the Contractor the sum of one million, thirty nine thousand, three hundred and forty-nine Dollars and zero Cents ($1,039,349.00), the Contract Amount. This sum is subject to additions or deductions made in accordance with the provisions of the Contract Documents.**

3.2 SOURCE OF FUNDS. City funds.

3.3 CONTRACT TIME. The Contract Time as used and defined in Article 11 herein shall be **120 calendar days from the date of the Notice To Proceed (form in writing issued by the City). Time is of the essence in the Project. The City and its residents will incur substantial damages and inconvenience if the Project is not completed as scheduled.** If completion date occurs after the 120 calendar-day period, Liquidated Damages will be assessed as stated in the Construction Agreement.

3.3.1 This work shall be completed in conjunction with project CW 013-2013B San Jose WWTP Site Preparation for Solar Power Generation System. Contract times for scope of work are as follows (in calendar days):

Notice to Proceed (NTP) for both CW 013-2013A & CW 013-2013B will be issued on the same day. Anticipated issue date is on or before June 4, 2014.

CW 013-2013B San Jose WWTP Site Preparation for Solar Power Generation System work shall be completed in a total of 75 days from the NTP. Within the first 30 days, mass grading will be complete and access to the solar panel field area shall be made available to the contractor for CW013-2013A. Within the following 45 days, the solar panel support/parking structure shall be completed.

CW013-2013A San Jose WWTP Photovoltaic (PV) Solar Power Generation System work shall be completed in a total of 120 days from the NTP. This onsite work shall begin 30 days from NTP after contractor for CW 013-2013B has completed mass grading so the solar field footing and panel installation can be completed. Within 75 days from NTP, contractor for CW 013-2013B shall have completed the solar panel support/parking structure for panel installation.

3.4 LIQUIDATED DAMAGES. Liquidated damages as used and defined in Article 11 herein shall be **$570 per calendar day or as otherwise agreed among the parties.**

3.5 OVERHEAD AND PROFIT. The limits on the amount of overhead and profit as used in Articles 2, 15 and 17 herein shall be fifteen percent (15%) overhead and twelve percent (12%) profit for the Contractor and Subcontractors.

3.6 CASH ALLOWANCES. The Contractor agrees that he has included in the contract price all cash allowances, if any, specified in the Contract Documents, and shall cause the work so covered to be done by such contractors as the Owner may direct, the Contract Amount being adjusted in conformity therewith. The Contractor agrees that the Contract Amount includes all his expenses and such profit as he deems proper in connection with the Cash Allowance. No demand for any sum other than those included in the Contract Amount shall be allowed in connection with the Cash Allowance and only direct costs may be charged against the Cash Allowance. If the cost, when determined, is more than or less than the allowance, the Contract Amount shall be adjusted accordingly by change order.

3.7 EXPENDITURE OF CASH ALLOWANCES. The Engineer and a person designated in writing by Owner, acting jointly, are authorized to act for and on behalf of the Owner and as Special Agents of the Owner in the expenditure of the Cash Allowances, including any allowance later added to the Contract Documents pursuant to the provisions for modifying the Contract Documents. No act of such Special Agents purporting to authorize any charge against any Cash Allowance shall be valid unless in the form of a written Change Order, specifying the particular work to be done and the whole cost thereof to the Owner, and signed by both Special Agents. The cost of extra work or changes shall be determined under the provisions of Article 15 of this Contract and General Conditions.

Said Special Agents are not authorized to exceed the amount of the Cash Allowance hereinbefore listed.

The Contractor is warned of, and agrees to, these express limitations on the authority of the Owner's Special Agents.

ARTICLE 4 - DEFINITIONS AND GENERAL PROVISIONS

4.1 OWNER, CONTRACTOR, AND ENGINEER. The Owner, the Contractor, and the Engineer are those herein defined in this Contract and General Conditions. They are treated throughout the Contract Documents as though each were of the singular number and masculine gender.

4.2 SUBCONTRACTOR. See Article 8.

4.3 NOTICE. See Article 10.

4.4 TIME. See Article 11.

4.5 COST. The term "Cost" shall include all charges, costs, losses, and expenditures of every kind whatsoever for the Work or portion thereof to which reference is made with respect to this term.

4.6 FINISH AND COMPLETION DATES. See Article 11.

4.7 CONTRACT DOCUMENTS. See also Article 1. A modification is:

4.7.1 A written amendment to the Contract and General Conditions signed by all parties;
4.7.2 A Change Order properly signed by all parties pursuant to Paragraph 15.1; or
4.7.3 A Field Order for a minor change in the Work issued by the Engineer pursuant to Paragraph 15.4.

A modification may be made only after execution of the Contract and General Conditions.

4.8 CONTRACT AND GENERAL CONDITIONS. The Contract and General Conditions consist of all the Contract Documents enumerated in Article 2. The Contract and General Conditions represents the entire and integrated agreement between the parties hereto and supersedes all prior negotiations, representations, or agreements, either written or oral, including the bidding documents. The Contract and General Conditions may be amended or modified only by a Modification as defined in Subparagraph 4.7.

4.9 WORK. The term "Work" includes, without limitation, furnishing all labor, administrative services and supervision necessary to produce the construction required by the Contract Documents and furnishing and installing all materials and equipment incorporated, or to be incorporated in such construction to complete the Project.

4.10 PROJECT. The Project is the total construction designed by the Engineer and depicted and described by the Contract Documents.

4.11 EXECUTION, CORRELATION, INTENT AND INTERPRETATIONS OF THE CONTRACT DOCUMENTS.

4.11.1 The Contract and General Conditions shall be signed by the Owner and the Contractor. By executing the Contract and General Conditions, each party accepts and agrees to be bound by each of the Contract Documents listed in Article 2.

4.11.2 By executing the Contract and General Conditions, the Contractor represents and warrants that he has made a reasonable examination of the site and the existing structures, if any, including the materials and methods of construction utilized in and the condition of the existing structures, has familiarized himself with the local conditions under which the Work is to be performed, including any and all relevant weather conditions or records or both, and correlated all of his observations with the provisions and requirements of the Contract Documents including, but not limited to, the details of demolition and construction indicated by the Plans and Specifications. Where discrepancies in quantities, materials, sizes or other conditions exist between the existing structure and the Plans and Specifications, the Contractor shall accomplish the Work required to carry out the intent of the Contract Documents and the actual requirements of the existing structure shall take precedence over the Plans and Specifications for purposes of determining the quantity and nature of the Work required herein.

4.11.3 The Contract Documents are complementary, and what is required by any one shall be as binding as if required by all. The intention of the Contract Documents is to include, without limitation, all labor, materials, equipment and other items as provided in Subparagraph 7.4.1 necessary for the proper execution and completion of the Work. Words which have well known technical or trade meanings are used herein in accordance with such recognized meanings.

4.11.4 The organization of the Specifications into divisions, sections and articles, and the arrangements of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade, or constituting part of the contract or having any legal or contractual significance.

4.11.5 Written interpretations necessary for the proper execution or progress of the Work, in the form of drawings or otherwise, will be issued with reasonable promptness by the Engineer in accordance with any schedule agreed upon or with reasonable promptness in any case. Such interpretations shall be consistent with and reasonable inferable from the Contract Documents, and may be effected or memorialized later by Field Order.

4.12 COPIES FURNISHED AND OWNERSHIP

4.12.1 The Contractor will be furnished, free of charge, all copies of Drawings and Specifications reasonably necessary for the execution of the Work, as determined by the Engineer.

4.12.2 All Drawings, Specifications and other data, and copies thereof, furnished to the Contractor are and shall remain the property of the Owner. They are not to be used on any other project and, with the exception of one set for each party of the Contract and General Conditions, are to be returned to the Owner upon request at the completion of the Work.

4.12.3 It shall be the responsibility of the Contractor to insure that each subcontractor and material supplier has a current set of Drawings, Specifications and Addenda, as required for proper execution of their respective portions of the Work.

ARTICLE 5 - ENGINEER

5.1 DEFINITION

5.1.1 The Engineer is the person or organization identified as such in this Contract and General Conditions and the term "Engineer" means the City Engineer of the City of Bisbee or his authorized representative.

5.1.2 Nothing contained in the contract Documents shall create any contractual relationship between the Engineer and the Contractor.

5.2 ADMINISTRATION OF THE CONTRACT

5.2.1 The City's Design Engineer will not provide construction services pursuant to its separate contract with the Owner, including performance of the functions hereinafter described. Those functions will be provided by the City Engineer, Thomas Klimek.

5.2.2 The Engineer will be the Owner's representative during construction to the extent described herein, until final payment and including the guarantee period. The Engineer will have authority to act on behalf of the Owner to the extent provided in the Contract Documents, unless otherwise modified by written instrument that will be shown to the Contractor. The Engineer will advise and consult with the Owner, and the Owner may issue instructions to the Contractor either directly or through the Engineer.

5.2.3 The Engineer and Owner shall at all times have access to the Work wherever it is in preparation and progress.

5.2.4 The Engineer shall make periodic visits to the site to become generally familiar with the progress and quality of the Work and to determine in general if the Work is proceeding in accordance with the Contract Documents. These visits shall be of the frequency necessary to apprise the Engineer of the progress and quality of the Work. On the basis of his on-site observations as an Engineer, he shall endeavor to guard the Owner against defect and deficiencies in the Work of the Contractor.

5.2.5 Based on such observations and the Contractor's Applications for Payment, the Engineer and Owner will determine the amounts owing to the Contractor and will issue Certificates for Payment in such amounts, as provided in Subparagraph 12.4.1.

5.2.6 The Engineer will be, in the first instance, the interpreter of the requirements of the Contract Documents and the judge of the performance there under by both the Owner and the Contractor, except where otherwise provided herein. The Engineer will render interpretations necessary for the proper execution or progress of the Work within a reasonable time so as not to delay the prosecution of the Work.

5.2.7 Claims, disputes and other matters in question relating to the execution or progress of the Work, payment, time extension or interpretation of the Contract Documents shall be referred to the Owner and the Engineer in the manner provided by Subparagraph 12.4.4, within the time limits prescribed in Subparagraph 15.2.1, for decision by the Engineer or Owner, as the subject of the matter may require, which decision will be rendered in writing within a reasonable time.

5.2.8 The interpretations and decisions of the Engineer shall be consistent with the intent of the Contract Documents. In his capacity as interpreter and judge, he will exercise his best efforts to insure faithful performance by both the Owner and the Contractor.

5.2.9 The Engineer decisions in matters relating to artistic effect will be final.

5.2.10 If a decision of the Engineer or the Owner is made pursuant to the terms of Subparagraph 5.2.7 which goes directly to the Contractor in writing, and it states that it is final

but subject to appeal, no claim, dispute, or other matter covered by such decision may be made later than thirty (30) days after the date on which the party making the demand received the decision. Appeal shall be to the Owner, whose decision is final, subject to any rights that the Contractor may have at law.

5.2.11 The Engineer and the Owner will each have authority to reject Work that does not conform to the Contract Documents. Whenever, in their reasonable opinion, either the Engineer or Owner considers it necessary or advisable to insure the proper implementation of the intent of the Contract Documents, they will have authority to require the Contractor to stop the Work or any portion thereof, or to require special inspection or testing of the Work as provided in Subparagraph 10.8.2 whether or not such Work be then fabricated, installed or completed. However, neither the Engineer's authority to act under this Subparagraph, nor any decision made by him in good faith either to exercise or not to exercise such authority, shall give rise to any duty of responsibility of the Engineer to the Contractor, any subcontractor or material supplier, any of their agents or employees, or any other performing any of the Work.

5.2.12 Within a reasonable time the Engineer will review Shop Drawings, Product Data and Samples promptly as provided in Subparagraphs 7.12.1 through 7.12.8, inclusive.

5.2.13 The Engineer will prepare Change Orders in accordance with Article 15. The Engineer will have authority to order minor changes in the Work not involving extra cost or an extension of the Contract time and not inconsistent with the Contract Documents as provided in Subparagraph 15.3.1.

5.2.14 The Engineer will conduct site visits to determine the date of Final Completion, shall notify the Owner of a date for inspections, and shall issue a Certificate of Final Completion. The Engineer will receive written warranties, record drawings, maintenance manuals and related documents required by the Contract and assembled by the Contractor, and will transmit a final Certificate for Payment to the Owner.

5.2.15 The duties, responsibilities and limitations of authority of the Engineer as the Owner's representative during construction are set forth in Articles 1 through 18, inclusive, of this Contract and General Conditions. The Owner may, by agreement with the Engineer, increase or diminish the responsibilities and duties of the Engineer as he may see fit in his sole discretion.

ARTICLE 6 - OWNER

6.1 DEFINITION

6.1.1 The Owner is the person or organization identified as such in the Contract and General Conditions. John A. MacKinnon, Interim City Manager/Attorney, City of Bisbee, or his designee, will be the Owner's representative on this Project.

6.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

6.2.1 Information or services under the Owner's control shall be furnished by the Owner with reasonable promptness to avoid delay in the orderly progress of the Work.

6.2.2 The Owner may issue instructions directly to the Contractor or through the Engineer.

6.2.3 All final decisions concerning Change Orders, Payments, Substantial Completion, Final Completion, Liquidated Damages and Contract Time shall be reserved to the Owner and this provision of the Contract shall take precedence over any other term hereof.

6.2.4 The foregoing are in addition to other duties and responsibilities of the Owner enumerated herein and especially those in respect to Payment and Insurance in Articles 12 and 14, respectively.

ARTICLE 7 - CONTRACTOR

7.1 DEFINITION

7.1.1 The Contractor is the person or organization identified as such in this Contract and General Conditions and the term "Contractor" means the Contractor or his authorized representative.

7.1.2 Whenever the words "as may be directed," "suitable," "or equal," "as approved," or other works of similar intent and meaning are used implying that judgment or discretion is to be exercised or a decision is to be made, it is understood that it is the judgment, discretion, or decision of the Engineer to which reference is made.

7.1.3 All materials and articles of any kind necessary for this Work are subject to the approval of the Engineer and his judgment and decision shall be final and conclusive.

7.1.4 Except as the Specifications may be modified (prior to the opening of Bids) by addenda and/or written approvals of equal items of equipment or materials as provided for in the bid documents, the successful contractor will he held to furnish all Work as specified in the bid documents.

7.1.5 After execution of the Contract, changes of brand named, trade named, trademarked, patented articles, or any other substitutions will be allowed only by written order signed by the Engineer, in which case the Owner shall receive all benefit of the difference in cost involved, except where choice of material or method is designated "or equal" in the specifications.

7.2 REVIEW OF CONTRACT DOCUMENTS AND SITE CONDITIONS

7.2.1 By executing this Contract the Contractor warrants that he has carefully studied and compared the Contract and General Conditions, Drawings, Specifications, Addenda, all other Contract Documents and the existing structure and has determined that the Contract Documents describe a completely buildable and functional Project. The Contractor does not

warrant the suitability or feasibility of the Owner's proposed operation of the Project. The Contractor shall at once report to the Engineer and the Owner any error, inconsistency or omission he may discover. The Contractor shall not be liable to the Owner or the Engineer for any damage resulting from any such errors, inconsistencies or omissions so long as the Engineer and the Owner are notified promptly thereof unless discovery of such error, inconsistency or omission should have been made by careful examination of the Contract Documents prior to submitting a Proposal. The Contractor shall do no Work without Drawings, Specifications or interpretations from the Engineer.

7.2.2 The Contractor shall be required to use for data and dimensions, figures marked on the drawings in preference to what the drawings may measure to scale. In the absence of figured dimensions, the Engineer shall be notified and the scale dimension verified.

7.2.3 The Contractor shall verify all dimensions shown and check all measurements in connection with any present improvements, driveways, or other existing conditions, before executing any work.

7.2.4 The Contractor agrees to comply fully with all applicable state, federal and local laws. Contractor agrees to indemnify and hold harmless the Owner and Engineer from all claims or whatever nature involving failure of the Contractor or any of its Subcontractors to comply with any federal, state or local law or ordinance in connection with this Project.

7.2.5 It is the Contractor's responsibility to inspect the site of the work to identify any surface or subsurface conditions or underground facilities that can be reasonably identified and that are materially different than what may be indicated in the Contract Documents prior to beginning the Work.

7.2.6 If the Contractor believes that any surface, subsurface or physical condition at the work site that is uncovered or revealed is of such a nature as to require a Change Order, because it either differs materially from that which is specifically designated on the Contract Documents or is of an unusual nature and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character required by the Contract at this location, then the Contractor shall promptly notify the Owner and Engineer in writing prior to further disturbing the site and performing the Work. The Engineer shall promptly review such notice and the conditions and advise the Owner and the Contractor whether additional tests may be required or a revision of the plans may be appropriate. The Contractor shall not be entitled to an adjustment in the Contract Price or Contract Time if the Contractor knew or should have known of the existence of such conditions at the time of the Bid was submitted; the existence of the condition could reasonably have been discovered or revealed as a result of the investigation or study of the site as required of the Contractor, or the Contractor failed to provide written notice of condition, as required in this section.

7.2.7 The information and data shown or indicated on the Contract Documents with respect to underground facilities at or around the location of the work is based upon information and data provided by the owners of these facilities. The Owner and Engineer are not responsible for the accuracy or completeness of this information. The Contractor is required to verify the

location any such utilities and to comply with all applicable laws and regulation regarding the location and protection of utilities. No additional compensation shall be provided for complying with these obligations.

7.3 SUPERVISION AND CONSTRUCTION PROCEDURES

7.3.1 The Contractor shall supervise the Work, using his best skill and attention. He shall be solely responsible for all construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract.

7.3.2 Contractor shall hold periodic meetings as often as reasonably required, but at least one a week, with subcontractors to monitor the progress of the Work. A report of the results of each such meeting shall be included in the Daily Report required by Subparagraph 7.10.2 herein. Contractor shall inform the Engineer at least twenty-four (24) hours in advance of the time for each meeting.

7.4 LABOR AND MATERIALS

7.4.1 Unless otherwise specifically noted, the Contractor shall provide and pay for all labor, material, equipment, tools, construction equipment, machinery, water, heat, utilities, waste and refuse disposal, transportation and any other facilities and services necessary for the proper execution and completion of the Work whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

7.4.2 Any work necessary to be performed after regular working hours, on Sundays, or legal holidays, shall be performed without additional expense to the Owner.

7.4.3 The Contractor shall at all times enforce strict discipline and good order among his employees and shall not employ on the Work any unfit person or anyone not skilled in the task assigned to him. When requested in writing by the Engineer or Owner, the Contractor shall remove from the Project any person who commits trespass or is, in the opinion of the Engineer or Owner, disorderly, dangerous, insubordinate, incompetent, or otherwise objectionable. If the Engineer requests such a removal, he shall notify the Owner in writing of his action. The Contractor shall keep the Owner harmless from damages or claims for compensation that may occur in the enforcement of this requirement.

7.5 WARRANTY

7.5.1 The Contractor warrants to the Owner that all material and equipment furnished under this Contract will be new unless otherwise specified, and that all Work will be of good quality, free from faults and defects and in conformance with the Contract Documents. Faults or defects are considered to be any aspect of the Work that is found not to be in conformance with the Contract Documents or any aspect of the Work that deteriorates becomes non-functional or otherwise fails, in some functional or aesthetic manner, to meet the requirements of the Contract Documents, normal wear and tear excepted. All Work not so conforming to these standards may be considered defective. If required by the Engineer or Owner, the

Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

7.5.2 The warranty provided in this Paragraph 7.5 shall be in addition to and not in limitation of any other warranty or remedy required by law or by the Contract Documents.

7.6 TAXES

7.6.1 The Contractor shall pay all sales, consumer, use, transaction privilege and other taxes required by law arising out of construction or other business activities of the Contractor in connection with the Project and in connection with the performance of this Contract, whether in force as of the date of this Contract or later imposed.

7.7 PERMITS, FEES AND NOTICES

7.7.1 Unless otherwise provided in the Plans, Specifications or by Addendum, Contractor will secure all permits, fees and licenses necessary for the proper execution and completion of the Work, including, but not limited to, building, plumbing, mechanical, electrical, and fire protection permits, but excluding plan check fees, which shall be paid for by the Owner. The Contractor shall pay for water meters, fire protection, water service, sewer connection, sewer fees or assessments, gas service, and electric service to procure all necessary utilities for the Project and for temporary utility hook-ups required during the course of construction. The Contractor shall pay for electric power and water necessary for the construction of the Project.

7.7.2 The Contractor shall give all notices and comply with all laws, ordinances, rules, regulations and orders of any public authority bearing on the performance of the Work. If the Contractor observes that any of the Contract Documents are at variance therewith in any respect, he shall promptly notify the Engineer and Owner in writing. If the Contractor performs any work knowing it to be contrary to such laws, ordinances, rules and regulations, and without such notice to the Engineer and Owner, he shall assume full responsibility therefore and shall bear all costs attributable thereto, including any reasonable attorney's fees incurred by Owner in connection therewith.

7.8 SUPERINTENDENT

7.8.1 The Contractor shall employ a competent Superintendent and necessary assistants who shall be in attendance at the Project site during the progress of the Work. The Superintendent shall be satisfactory to the Engineer and Owner and shall not be changed except with the consent of the Engineer and Owner. The Superintendent shall represent the Contractor, and all communications given to the Superintendent shall be as binding as if given to the Contractor. Important communications will be confirmed in writing. Other communications will be so confirmed on written request in each case.

7.9 RESPONSIBILITY FOR THOSE PERFORMING THE WORK

7.9.1 The Contractor shall be responsible to the Owner for the acts and omissions of all his employees and all Subcontractors, their agents and employees, and all other persons performing any of the Work or supplying any material or equipment to be incorporated in the Work under a contract of any nature with the Contractor.

7.10 PROGRESS SCHEDULE AND REPORTS

7.10.1 The Contractor, immediately after being awarded the Contract, shall prepare and submit for the Engineer's and Owner's approval an estimated Progress Schedule for the Work. The progress schedule shall be related to the entire Project and shall indicate the dates for the starting and completion of the various components and phases of construction and shall be revised as required by the conditions of the Work, upon request of and subject to the approval of the Engineer and Owner. The Contractor agrees to promptly respond to all inquiries by the Engineer or Owner concerning substantial deviation of the progress of construction from the Progress Schedule. Failure to timely respond to such request or substantial delay from the schedule may result in progress payments being withheld.

The Progress Schedule shall include projected dates of submittal of all items of material for which submittals are required and shall include delivery dates of all items of material and equipment that are considered critical or long lead time. The Contractor shall submit a biweekly report summarizing all deviations from the Progress Schedule that will or may result in delay of the Project.

7.10.2 The Contractor shall prepare and submit for the Owner's information, review and approval for the duration of the Work a Daily Report in a form acceptable to Owner. The Daily Report shall be completed daily and submitted to the Owner and Engineer on a weekly basis as a statement and review of the progress of the Work.

7.10.3 The Contractor shall furnish sufficient labor force, materials, plant, and equipment to ensure the prosecution of the Work in accordance with the approved Progress Schedule. If the Contractor's prosecution of the Work falls behind the Progress Schedule, Contractor shall take such steps as may be necessary to regain compliance with the Progress Schedule including additional labor or services or work such overtime as may be necessary to bring his operations up to schedule. Failure to maintain schedule or to take the above steps to regain the agreed Progress Schedule shall constitute default under this Contract.

7.11 DRAWINGS AND SPECIFICATIONS AT THE SITE

7.11.1 The Contractor shall maintain at the site for the Owner one (1) copy of all Drawings, Specifications, Addenda, approved Shop Drawings, Change Orders, other Modifications, and manufacturers' printed specifications and recommendations, in good order and marked carefully and accurately to record all changes made during construction and shall be available to the Engineer and Owner at all times. Upon completion of the Project, a clean set of Drawings shall be accurately marked to depict the as-built condition of the Project, and these Drawings along with all record drawing, shall be delivered to the Owner upon completion of the Work.

7.11.2 The Contractor shall also submit to the Engineer for his record two copies each of all manufacturers' maintenance manuals, printed specifications and recommendations, which by reference in the several divisions of the Engineer's specifications are a part thereof.

7.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

7.12.1 Shop Drawings and Product Data are drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are prepared or supplied by the Contractor or any Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor, and which illustrate or describe some portion of the Work.

7.12.2 Samples are physical examples furnished by the Contractor to illustrate materials, equipment or workmanship, and to establish standards by which the Work will be judged.

7.12.3 The Contractor shall review, stamp with his approval and submit, with promptness and in orderly sequence so as to cause no delay in the Work or in the work of any other contractor, all Shop Drawings, Product Data and Samples required by the Contract Documents or subsequently by the Engineer as covered by Modifications. The Contractor shall, within ten (10) days after the notice to proceed, submit to the Engineer for his approval a schedule indicating the date that each required Shop Drawing and Product Data submittal will be delivered to Engineer. Shop Drawings, Product Data and Samples shall be properly identified as specified, or as the Engineer may require. At the time of submission the Contractor shall inform the Engineer in writing of any deviation of the Shop Drawings, Product Data or Samples from the requirements of the Contract Documents.

7.12.4 By approving and submitting Shop Drawings, Product Data and Samples, the Contractor thereby represents that he has determined and verified all field measurements, field construction criteria, materials, catalog numbers and similar data, or will do so, and that he has checked and coordinated each Shop Drawing, Product Data and Sample with the requirements of the Work and of the Contract Documents.

7.12.5 The Engineer will review and return Shop drawings, Product Data and Samples with reasonable promptness so as to cause no delay, but such review is only for conformance with the design concept of the Project and with the information given in the Contract Documents. The Engineer's approval of a separate item shall not indicate approval of an assembly in which the item functions.

7.12.6 The Contractor shall make any corrections required by the Engineer to comply with the Contract Documents and shall resubmit the required number of corrected copies of Shop Drawings, Product Data or new Samples until approved. The Contractor shall direct specific attention in writing or on resubmitted Shop Drawings or Product Data to revisions other than the corrections requested by the Engineer on previous submissions.

7.12.7 The Engineer's approval of Shop Drawings, Product Data or Samples shall not relieve the Contractor of responsibility for any deviation from the requirements of the Contract

Documents unless the Contractor has informed the Engineer and Owner in writing of such deviation at the time of submission and the Engineer and Owner have given written approval to the specific deviation, nor shall the Engineer's approval relieve the Contractor from responsibility for errors or omissions in the Shop Drawings or Samples.

7.12.8 No portion of the Work requiring a Shop Drawing, Product Data or Sample submission shall be commenced until the submission has been approved by the Engineer. All such portions of the Work shall be in accordance with approved Shop Drawings, Product Data and Samples.

7.13 CLEANING UP

7.13.1 The Contractor at all times during the progress of the Work shall keep the premises free from accumulation of waste materials or rubbish caused by his operations. At the completion of the Work he shall remove all his waste materials and rubbish from and about the Project as well as all his tools, construction equipment, machinery and surplus materials specified to be left at the site, and shall clean all glass surfaces.

7.13.2 If the Contractor fails to satisfactorily clean up, the Owner will do so and the cost thereof shall be charged to the Contractor as provided in Paragraph 10.6.

7.14 COMMUNICATIONS

7.14.1 The Contractor shall forward all communications to the Engineer except where otherwise required herein or otherwise directed by the Owner.

7.15 INDEMNIFICATION CLAUSE

7.15.1 Indemnification. To the fullest extent permitted by law, the Contractor shall defend, indemnify and hold harmless the Owner, its agents, officers, officials and employees from and against all claims, damages, losses and expenses (including but not limited to attorney fees, court costs, and the cost of appellate proceedings), relating to, arising out of or alleged to have resulted from the acts, errors, mistakes, omissions, work or services of the Contractor, its agents, employees, or any tier of Contractor's Subcontractors in the performance of this Contract. Contractor's duty to defend, hold harmless and indemnify the Owner, its agents, officers, officials and employees shall arise in connection with any tortuous claim, damage, loss or expense that is attributable to bodily injury, sickness, disease, death, or injury to, impairment, or destruction of property including loss of use resulting there from, caused by the Contractors' acts, errors, mistakes, omissions, work or services in the performance of this Contract including any employee of the Contractor, any tier of Contractor's Subcontractor or any other person for whose acts, errors, mistakes, omissions, work or services the Contractor may be in legally liable. The extent of the foregoing compensation for indemnity payments shall be limited to and determined by the respective fault of the parties, their agents, subcontractors and employees, in comparison to others (including, but not limited to the Owner) who may have contributed to or caused, in whole or in part, the legal basis for any such claim.

7.15.2 The amount and type of insurance coverage requirements set forth herein will in no way be construed as limiting the scope of the indemnity in this paragraph.

ARTICLE 8 - SUBCONTRACTORS

8.1 DEFINITION

8.1.1 A Subcontractor is a person or organization who has a direct contract with the Contractor to supply materials or equipment or to perform any of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and masculine in gender and means a Subcontractor or his authorized representative.

8.1.2 A Sub-subcontractor is a person or organization who has a direct or indirect contract with the Subcontractor to perform any of the Work at the site, or to supply any materials or equipment to be used in the Project. The term "Sub-subcontractor" is referred to throughout the Contract Documents as singular in number and masculine in gender, and means a Sub-subcontractor or an authorized representative thereof.

8.1.3 Nothing contained in the Contract Documents shall create any contractual, master-servant or principal-agent relationship between the Owner or the Engineer and any Subcontractor or Sub-subcontractor.

8.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

8.2.1 Prior to the award of the contract, the Contractor shall supply to the Owner a complete list of subcontractors and material vendors. The Engineer shall notify the apparent successful bidder in writing if the Owner has reasonable objection to any person or organization on the list of subcontractors and material vendors. Failure of the Owner to make an objection to any person or organization on the list prior to the award shall constitute acceptance of such person or organization.

8.2.2 If, prior to the award of the Contract, the Owner has a reasonable and substantial objection to any person or organization of such list, and refuses in writing to accept such person or organization, the apparent successful bidder may prior to the award, withdraw his bid without forfeiture of bid security. If the bidder submits an acceptable substitute with an increase in his bid price to cover the difference in cost occasioned by such substitution before the award, the Owner may, at his discretion accept the increased bid price or he may disqualify the bid. If, after the award, the Owner refuses to accept any person or organization on such list, the Contractor shall submit an acceptable substitute and the Contract Amount shall be increased or decreased by the difference in cost occasioned by such substitution and an appropriate Change Order shall be issued; however, no increase in the Contract Amount shall be allowed for any such substitution unless the Contractor has acted promptly and responsibly in submitting a name with respect thereto.

8.2.3 The Contractor shall not contract with any Subcontractor proposed for portions of the Work designated in the bidding requirements or if none is so designated, with any Subcontractor proposed for the principal portions of the Work who has not been accepted by the Owner. The Contractor will not be required to contract with any Subcontractor against whom he has a reasonable objection.

8.2.4 If the Owner, without cause, requires a change of any proposed Subcontractor previously accepted by it, the Contract Amount shall be increased or decreased by the difference in cost occasioned by such change and an appropriate Change Order shall be issued.

8.2.5 The Contractor shall not make any substitution for any Subcontractor who has been accepted by the Owner unless the substitution is approved in writing by the Owner.

8.3 SUBCONTRACTUAL RELATIONS

8.3.1 All work performed for the Contractor by a Subcontractor shall be pursuant to an appropriate written agreement between the Contractor and the Subcontractor (and where appropriate between Subcontractors and Sub-subcontractors) which shall contain provision that:

.1 preserve and protect the rights of the Owner and the Engineer under the Contract with respect to the Work to be performed under the subcontract so that the subcontracting thereof will not prejudice such rights.

.2 require that such work be performed in accordance with the requirements of the Contract Documents, including, but not limited to:

a. require submission to the Contractor of applications for payment under each subcontract to which the Contractor is a party, in reasonable time to enable the Contractor to apply for payment in accordance with Article 12;
b. require that all claims for additional costs, extensions of time, damages for delays or otherwise with respect to subcontracted portions of the Work shall be submitted to the Contractor (via any Subcontractor or Sub-subcontractor where appropriate) in the manner provided in the Contract Documents for like claims by the Contractor upon the Owner pursuant to Paragraph 15.2;
c. obligate such Subcontractor specifically to consent to the provisions of this Paragraph 8.3;
d. require such Subcontractor to submit a lien waiver and release of claim in a form prescribed by the Owner along with each application for payment, which release and waiver shall in turn be given to the Owner and which shall cover all Work done prior to the date of the application for payment;
e. require such Subcontractor to comply with all laws, indemnify Owner and agree to the provision of Paragraphs 7.2.4 and 7.15;
f. require such Subcontractor to comply with all Labor Standards and other Federal regulations required by the Arizona Department of Housing, CDBG Program in accordance with Paragraph 7.2.4.

.3 waive all rights the contracting parties may have against one another for damages caused by fire or other perils covered by the property insurance described in Article 14, except such rights as they may have to the proceeds of such insurance held by the Owner as trustee under Article 14.

8.4 PAYMENTS TO SUBCONTRACTORS

8.4.1 The Engineer may, on request and at this discretion, furnish to any Subcontractor, if practicable, information regarding percentages of completion certified to the Contractor on account of work done by such Subcontractors.

8.4.2 Neither the Owner nor the Engineer shall have any obligation to pay or to see to the payment of any monies to any Subcontractor except as may otherwise be provided in this Contract.

ARTICLE 9 - SEPARATE CONTRACTS

9.1 OWNER'S RIGHT TO AWARD SEPARATE CONTRACTS

9.1.1 The Owner reserves the right to award other contracts in connection with other portions of the Project under conditions similar to this Contract.

9.2 MUTUAL RESPONSIBILITY OF CONTRACTORS

9.2.1 The Contractor shall afford other contractors reasonable opportunity for the introduction and storage of their materials and equipment and the execution of their work, and shall properly connect and coordinate his Work with theirs.

9.2.2 If any part of the Contractor's Work depends for proper execution or results upon the work of any other separate contractor, the Contractor shall inspect and promptly report to the Engineer any apparent discrepancies or defects in such work that render it unsuitable for such proper execution and results. Failure of the Contractor to so inspect and report shall constitute an acceptance of the other contractor's work as fit and proper to receive his Work, except as to defects which may develop in the other separate contractor's work after the execution of the Contractor's Work.

9.2.3 Should the Contractor cause damage to the Work or property of any separate contractor on the Project, the Contractor shall, upon written notice, promptly settle such other contractor's claim, if he will so settle. If such separate contractor sues the Owner on account of any damage alleged to have been so sustained, the Owner shall defend such proceedings at the Contractor's expense, and if any judgment against the Owner arises there from, the Contractor shall promptly pay or satisfy it and shall immediately, upon presentation to it of a statement thereof, reimburse the Owner for all attorney's fees and court costs which the Owner has incurred.

9.3 OWNER'S RIGHT TO CLEAN UP

9.3.1 If a dispute arises between the separate contractors as to their responsibility for cleaning up as required by Paragraph 7.13, the Owner may clean up and charge the cost thereof to the several contractors as the Owner shall determine to be just.

ARTICLE 10 - MISCELLANEOUS PROVISION

10.1 LAW OF THE PLACE

10.1.1 The contract shall be governed by the law of Arizona and any action relating to this Contract shall be brought in an Arizona court of competent jurisdiction located in Cochise Owner.

10.2 SUCCESSORS AND ASSIGNS

10.2.1 The Owner and the Contractor each binds himself, his partners, successors, assigns and legal representatives to the other party hereto and to the partners, successors, assigns and legal representatives of such other party in respect to all covenants' agreements and obligations contained in the Contract Documents. The Contractor shall not assign the Contract or any part hereof or sublet it as a whole or in part without the previous written consent of the Owner, nor shall the Contractor assign or pledge any monies due or to become due to him hereunder, without the previous written consent of the Owner.

10.3 WRITTEN NOTICE

10.3.1 Written notice shall be deemed to have been duly served if delivered in person to the individual for whom it was intended, or if delivered at or sent by registered or certified mail to the last business address known to him who gives the notice as appropriate. Notice to the Engineer is notice to the Owner except for notice of inconsistencies, error or omission in the Contract Documents, request for extension of time, request for changes in the Contract Amount, appeal of decisions by Engineer or Owner and notice of claim or legal process. All such notices shall be given to both Engineer and Owner.

10.4 CLAIMS FOR DAMAGES

10.4.1 Should either party of the Contract suffer injury or damage to person or property because of any act or omission of the other party or of any of his employees, agents or others for whose acts he is legally liable, claim shall be made in writing to such other party within a reasonable time after the first observance of such injury or damage. All claims made by the Contractor under this Contract are subject to the limitations set forth in Paragraph 15.2 herein.

10.5 PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND

10.5.1 The Contractor shall furnish performance and labor and material payment bonds covering the faithful performance of the Contract and the payment of all obligations arising there under in such form and amount as the Owner may prescribe and with such sureties as

may be agreeable to the Owner. The premiums shall be paid by the Contractor. The Contractor shall, prior to commencement of the Work, submit such bonds to the Owner.

10.6 OWNER'S RIGHT TO COMPLETE THE WORK

10.6.1 If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents, or fails to perform any provision of the Contract, the Owner may, after seven (7) days written notice to the Contractor and his surety, and without prejudice to any other remedy he may have, proceed to make such other necessary and reasonable arrangements to carry out the Work in accordance with the Contract Documents, all at the expense of the Contractor, including the attorneys' fees and other costs incurred by Owner.

10.7 ROYALTIES AND PATENTS

10.7.1 The Contractor shall pay all royalties and license fees and shall defend all suits or claims from infringement of any patent right and shall save the Owner harmless from loss of account thereof, including Owner's attorneys' fees and court costs, except that Owner shall be responsible for all such loss when a particular design, process or product of a particular manufacturer or manufacturers is specified. But, if the Contractor has reason to believe that the design, process or products specified is an infringement of a patent, he shall be responsible for such loss unless he promptly gives information to the Engineer prior to starting the Work.

10.8 TESTS

10.8.1 Where the Contract Documents, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction require any of the Work to be inspected, tested or approved, the Contractor shall give the Engineer timely notice of its readiness and of the date arranged so the Engineer may observe such inspection, testing or approval.

10.8.2 The Contractor shall be responsible that all equipment and materials used in the construction of the Project, especially those upon which the strength and durability of the structure may depend, shall be subject to adequate inspection and testing in accordance with accepted standards to establish conformity with Specifications, applicable codes and standards and suitability for use intended.

10.8.3 If after the commencement of the Work the Engineer determines that any of the Work requires special inspection, testing, or approval which subparagraph 10.8.1 does not include, he will, upon written authorization from the Owner, order such special inspection, testing or approval, and the Contractor shall give notice of readiness as in Subparagraph 10.8.1.

10.8.4 If such special inspection or testing reveals a failure of the Work to comply:

.1 with the requirements of the Contract Documents, or

.2 with respect to the performance of the Work, with laws, ordinances, rules regulations or orders of any public authority having jurisdiction over the Work, the Contractor shall bear all costs thereof, including the Engineer's additional services made necessary by such

failure, and the costs of such inspection or testing; otherwise the Owner shall bear such costs of special inspection.

10.8.5 Required certificates of re-inspections or testing to secure compliance with 10.8.4.1 or 10.8.4.2 above shall be paid for by the Contractor.

10.8.6 If the Engineer wishes to observe the inspections, tests or approvals required by this Paragraph 10.8, he will do so promptly and, where appropriate, at the source of supply.

10.8.7 Neither the observations of the Engineer in his administration of the Contract, nor inspections, tests or approvals by person other than the Contractor shall relieve the Contractor from his obligations to perform the Work in accordance with the Contract Documents.

10.9 LEGAL FEES AND COSTS

10.9.1 The party substantially prevailing shall be entitled to recover its attorneys' fees, any costs of suit, any expert witness fees and the actual cost of any test or inspection incurred in connection with any effort undertaken to enforce any of the terms of this Contract.

10.10 SEVERABILITY

10.10.1 In the event any provision in this contract is held invalid by any court of competent jurisdiction, the remaining provision in this Contract shall be deemed severable and shall remain in full force and effect.

ARTICLE 11 - TIME

11.1 TIME AND LIQUIDATED DAMAGES.

11.1.1 It is understood and agreed that the construction of the Work under the Contract Documents shall be commenced on the date stated in the Notice to Proceed issued by the Engineer and shall be completed by the Contractor within the number of calendar days specified in Paragraph 3.3. hereof (the "Finish Date"). The Contract Time is the period of time specified in Paragraph 3.3. hereof running from (1) the date specified in the Notice to Proceed as the date upon which the Contractor is to commence the Work (the "Start Date"), through (2) the Finish Date. The date of beginning, rate of progress, and time for completion are essential conditions of the Contract, and the Contractor agrees that said Work shall be prosecuted regularly, diligently, and uninterruptedly as such rate of progress as will insure full completion thereof within the Contract Time specified. It is expressly agreed that the Contract Time is reasonable.

11.1.2 If the Final Completion Date as defined in Subparagraph 11.1.4, occurs after the expiration of the Contract Time, the Contractor shall pay the Owner the sum specified in Paragraph 3.4 hereof as liquidated damages for each calendar day the Work remains incomplete after expiration of the Contract Time. This amount is agreed upon because of the impracticability and extreme difficulty of ascertaining the actual damages the Owner would

sustain. It is expressly agreed that the amount of liquidated damages set forth herein is reasonable. Said amounts may be retained from time to time by the Owner from payments due the Contractor.

11.1.3 The date of Completion of the Work, or designated portion thereof, is the date certified in writing by the Engineer when construction is sufficiently complete, in accordance with the Contract Documents as they may have been modified by any Change Orders agreed to by the parties, so that the Owner may occupy the project, or a designated portion thereof, if he so elects, for the use for which it is intended. Certification of a designated portion of the Work by the Engineer as being "Complete" and occupancy of that portion thereafter by the Owner shall neither release, or otherwise operate to excuse, the Contractor from his duty to complete the remainder of the Work within the Contract Time nor relieve the Contractor from any liability for not completing the remainder of Work within the Contract Time including liability for liquidated damages.

11.1.4 The Final Completion Date is the calendar date when all items of the Work are one hundred percent (100%) finished, with no items of any scope, large or small, outstanding and remaining to be constructed, and all known defective work has been corrected. When the Engineer certifies in writing, pursuant to the terms of paragraph 12.6.2, that the Final Completion Date is reached and it is approved by the Owner, the Contractor may make application for final payment pursuant to Subparagraph 12.6.2.

11.1.5 In any case where the terms of any other provision of the Contract may be construed to be in conflict with any term regarding time for completion of the Project, interpretation of the conflicting terms which gives precedence to the term regarding time for completion shall govern.

11.2 PROGRESS AND COMPLETION

11.2.1 All time limits stated in the Contract Documents are of the essence of the Contract.

11.2.2 The Contractor shall begin the Work on the Start Date as defined in Subparagraph 11.1.1 and shall carry the Work forward expeditiously, uninterruptedly and with adequate forces and shall complete it within the Contract Time.

11.3 DELAYS AND EXTENSION OF TIME

11.3.1 If the Contractor is delayed at any time in the progress of the Work by any cause which the Owner determines may justify the delay, including, but not limited to, acts of God, acts of the public enemy, acts of the Owner, acts of another contract in performance of a contract with the Owner, fires, floods, epidemics, quarantine restriction, freight embargoes and adverse weather detrimental to completion of the Work and, in the aggregate, materially different than weather normally experienced during the entire Contract Time, then the Contract Time shall be extended by Change Order for such reasonable time as the Owner may determine.

11.3.2 All claims for extension of time shall be made in writing to the Engineer and Owner no more than fourteen (14) days after the occurrence of the delay; otherwise, they shall be waived. In the case of a continuing cause of delay, only one claim is necessary. The Contractor shall promptly notify the Engineer in writing of the date of the termination of the continuing cause of delay.

11.3.3 If no schedule or agreement is made stating the dates upon which written interpretations as set forth in Subparagraph 4.11.5 shall be furnished, then no claim for delay shall be allowed on account of failure to furnish such interpretations until fifteen (15) days after demand is made for them, and not then unless such claim is reasonable.

ARTICLE 12 - PAYMENTS AND COMPLETION

12.1 CONTRACT AMOUNT

12.1.1 The Contract Amount is as stated in this Contract and General Conditions and is the total amount payable by the Owner to the Contractor for the performance of the Work under the Contract Documents, subject to credits or increases resulting from Change Orders. In no event shall Owner be responsible for more than the Contract Amount.

12.2 SCHEDULE OF VALUES

12.2.1 Before the first Application for Payment, the Contractor shall submit to the Engineer and Owner a detailed schedule of values reflecting as nearly as reasonably possible the actual values of the various components of the Work aggregating the total Contract Amount, prepared in such detail and such form as the Engineer may require, and supported by such data to substantiate its correctness as the Engineer may require. Each item in the schedule of values may include its proper share of overhead and profit or such overhead and profit may be shown as separate line items and shall be billed in proportion the percent of the Project completed.

12.3 PROGRESS PAYMENTS

12.3.1 On or about the twenty-fifth day of each calendar month during the course of construction, the Contractor shall submit to the Engineer and Owner an itemized Application for Payment supported by such data substantiating the Contractor's right to payment as the Owner or the Engineer may require. Contractor shall also submit a release of claim and lien waiver covering all work performed to date, including the work of each Subcontractor and material supplier.

12.3.2 Payments shall be based on the Work actually performed during the preceding calendar month. Payment may be made for materials not incorporated in the Work but delivered and suitably stored at the site, or at some other location under such conditions agreed upon in writing by the Engineer and Owner to be transported to the site and installed at a later date.

12.3.3 Material delivered and suitably stored at the site, or at some other agreed upon location by the Contractor, subcontractors, sub-subcontractors, or material suppliers shall remain the responsibility of the Contractor until incorporated into the Work, shall be insured for the benefit of the Owner to the full value of the material and shall be suitably stored and protected. Only such material that is in accordance with the Contract Documents shall be installed into the Work. Until the final completion and acceptance of the Work by the Owner, it shall be the Contractor's responsibility to protect all materials to be installed in or delivered to the Project.

12.3.4 The Contractor warrants and guarantees that title for all work, materials and equipment covered by an Application for Payment shall pass to the Owner either by incorporation in the Project or upon receipt of payment by the Contractor, whichever occurs first and that such work, materials and equipment shall be free and clear of all liens, claims, security interests or encumbrances, hereinafter referred to in this Article 12 as "claims."

12.4 APPROVALS FOR PAYMENT

12.4.1 If the Contractor has made application for payment as above, then not later than seven (7) days after the date of submission, the Engineer shall issue his approval of the Application for Payment and forward his approval of the Application to the Owner for such amount as he determines to be properly due, or state in writing his reasons for withholding, in whole or in part the amount applied for as provided in Subparagraph 12.5.1.

12.4.2 Approval of the Application for Payment will constitute a representation by the Engineer to the Owner, based on his observations at the site as provided in Subparagraph 5.2.4, and the data comprising the Application for Payment, the Work has progressed to the point indicated; that, to the best of his knowledge, information and belief, the quality of the Work is in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole upon Completion, to the results of any subsequent tests required by the Contract Documents, to minor deviations from the Contract Documents correctable prior to final completion and to any specific qualifications stated in his approval of the Application of Payment); and that the Contractor is entitled to payment in the amount approved. In addition, the Engineer final approval for payment will constitute a further representation that the conditions precedent to the Contractor's being entitled to final payment, as set forth in Subparagraph 12.6.2, have been fulfilled.

12.4.3 After the Engineer has approved an Application for Payment and has promptly forwarded this approval to the Owner, the Owner shall make a payment to the Contractor as soon as grant funds become available from the State CDBG Program to the Owner, or sooner, at the OWNER's discretion, and subject to compliance with labor standard requirements. Payment will be based on ninety percent (90%) of the value of the Work actually performed during the preceding calendar month in accordance with Subparagraph 12.3.3 and approved by Engineer until the contract is fifty percent (50%) completed. If the Contractor is making satisfactory progress when the contract is fifty (50%) completed, the Contractor shall be entitled to a reduction in the retention amount, as required by ARS §34-221.C. Any amounts retained by Owner shall be paid to the Contractor, as previously specified, after the Final

Completion Date as specified in Paragraph 12.6.1 hereof, provided the Contractor has by that time duly furnished the Owner consent of surety, lien waivers, any and all operating manuals, wiring diagrams, control diagrams, maintenance manuals, equipment and appliance warranties, record drawings, warranties and other documents of any nature called for in the Contract Documents or required for the proper functioning of the Work as a whole and has otherwise performed all of Contractors' obligations under the Contract Documents. In lieu of this retention, the Contractor may provide alternative security in the manner authorized by law.

12.4.4 In this Application for Payment, or in a separate notice, the Contractor shall include and itemize, and furnish such supporting particulars as the Engineer or Owner shall require, all claims for additional compensation against the Owner arising under the Contract Documents or any covenant thereof, express or implied, or from any cause whatsoever, within the time limits prescribed in Subparagraph 15.2.1. It is expressly covenanted that the purpose of this provision is to guard the Owner against surprise claims, to permit the Owner to investigate claims as the same may arise. It is expressly covenanted that the Owner shall have no liability on any claim unless such claim was approved by Engineer and was submitted in writing at the time and in the manner required hereby.

12.4.5 No certificate for a progress payment, nor any progress payment, nor any partial or entire use or occupancy of the Project by the Owner, shall constitute an acceptance of any Work not in accordance with the Contract Documents.

12.5 PAYMENT WITHHELD

12.5.1 The Engineer or Owner may decline to approve an Application for Payment and the Engineer may withhold his Certificate in whole or in part if in his opinion he is unable to make representations to the Owner as provided in Subparagraph 12.4.2. The Engineer may also decline to approve any Applications for Payment or, because of subsequently discovered evidence or subsequent inspections, he may nullify the whole or any part of any Certificate for Payment previously issued to such extent as may be necessary in his opinion to protect the Owner from loss because of:

.1 defective work not remedied,
.2 claims filed or reasonable evidence indicating probable filing of claims,
.3 reasonable doubt that the Work can be completed for the unpaid balance of the Contract Amount,
.4 damage to another contractor,
.5 reasonable indication that the Work will not be completed within the Contract Time, or
.6 unsatisfactory prosecution of the Work by the Contractor or other material breach of this Contract.
.7 failure to complete all Labor Standards requirements

12.5.2 When the above grounds in Subparagraph 12.5.1 are removed or in the case of 12.5.1.3 above, when the Owner is satisfied that the Contractor will complete the Project at the agreed upon price, payment shall be made for amounts withheld because of them.

12.6 COMPLETION AND FINAL PAYMENT

12.6.1 Upon receipt of written notice that the Work is ready for final inspection and acceptance, the Engineer will promptly make such inspection and, when the Engineer finds (1) the Work in accordance with and acceptable under the Contract Documents, (2) the Work completed under the Contract fully performed and (3) the Final Completion Date has been reached, as that term is defined in Subparagraph 11.1.4, then, and only then, the Engineer shall promptly state in writing that, to the best of his knowledge, information and belief, and on the basis of observations and inspections, the Work has been fully completed in accordance with the terms and conditions of the Contract Documents, that the entire balance found to be due the Contractor is payable. The Engineer's written notice required by this paragraph shall state the Date of Final Completion.

12.6.2 The making of final payment shall constitute a waiver of all claims by the Owner except those arising from:

.1 unsettled claims,
.2 faulty or defective Work,
.3 failure of the Work to comply with the requirements of the Contract Documents, or
.4 terms of any guarantees required by the Contract Documents.

12.6.3 The acceptance of final payment shall constitute a waiver of all claims by the Contractor.

12.6.4 No earlier than three weeks before the expiration of the warranty period for the Work specified in Subparagraph 18.1 herein, or at such other additional earlier time or times as the Owner may agree, the Owner and/or the Engineer, in company with the Contractor, shall make an inspection of the Project and certify that all defects in material and workmanship occurring during this period have been satisfactorily corrected.

ARTICLE 13 - PROTECTION OF PERSONS AND PROPERTY

13.1 SAFETY PRECAUTIONS AND PROGRAMS

13.1.1 The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work in compliance with all local, state and federal laws and regulations.

13.2.1 The Contractor shall take all reasonable precautions for the safety of, and shall provide all reasonable protection to prevent damage, injury or loss, to:

.1 all employees engaged in the Work and all other persons who may be affected thereby;
.2 all the Work and all materials and equipment to be incorporated therein, whether in storage on or off the site, under the care, custody or control of the Contractor or any of his Subcontractors or Sub-subcontractors; and

.3 other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

13.2.2 The Contractor shall comply with all applicable laws, ordinances, rules, regulations and orders of any public authority having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss. He shall erect and maintain, as required by existing conditions and the progress of the Work, all reasonable safeguards for safety and protection, including, but not limited to, posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent utilities and property.

13.2.3 When the use or storage of explosives or other hazardous materials or equipment is necessary for the execution of the Work, the Contractor shall exercise the utmost care and shall carry on such activities under the supervision of properly qualified personnel.

13.2.4 All damage or loss to any property caused in whole or in part by the Contractor, any Subcontractor, any Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable, shall be remedied by the Contractor, except damage or loss attributable to faulty Drawings or Specifications or the acts or omissions of the Owner or Engineer or anyone employed by either of them or for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor.

13.2.5 The Contractor shall designate a responsible member of his organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's Superintendent unless otherwise designated in writing by the Contractor or the Engineer.
13.2.6 The Contractor shall not load or permit any part of the Work to be loaded so as to endanger its safety.

13.3 EMERGENCIES

13.3.1 In any emergency affecting the safety of persons or property, the Contractor shall act to prevent threatened damage, injury or loss. Any additional compensation or extension of time claimed by the Contractor on account of emergency work shall be determined as provided by the applicable provision of the Contract Documents.

ARTICLE 14 - INSURANCE

14.1 CONTRACTOR'S INSURANCE

14.2 The Contractor at Contractor's own expense, shall purchase and maintain the herein stipulated minimum insurance with companies duly licensed, possessing a current A.M. Best, Inc. Rate of A10, or approved by Owner in its sole discretion and licensed to do business in the State of Arizona with policies and forms satisfactory to the Owner.

14.3 All insurance required herein shall be maintained in full force and effect until all work or service required to be performed under the terms of the Contract is satisfactorily completed and formally accepted; failure to do so may, at the sole discretion of the Owner, constitute a material breach of this Contract.

14.4 The Contractor's insurance shall be primary insurance as respects the Owner, and any insurance or self-insurance maintained by the Owner shall not contribute to it.

14.5 Any failure to comply with the claim reporting provisions of the insurance policies or any breach of an insurance policy warranty shall not affect coverage afforded under the insurance policies to protect the Owner.

14.6 The insurance policies, except Workers' Compensation, shall contain a waiver of transfer rights of recovery (subrogation) against the Owner, its agents, officers, officials and employees for any claims arising out of the Contractor's acts, errors, mistakes, omissions, work or service.

14.7 The insurance policies may provide coverage which contains deductible or self-insured retentions. Such deductible and/or self-insured retentions shall not be applicable with respect to the coverage provided to the Owner under such policies. The Contractor shall be solely responsible for the deductible and/or insured retention and the Owner, at its option, may require the Contractor to secure payment of such deductibles or self-insured retentions by a Surety Bond or an irrevocable and unconditional letter of credit.

14.8 The Owner reserves the right to request and to receive, within ten (10) working days, certified copies of any or all of the herein required insurance policies and/or endorsements. The Owner shall not be obligated, however, to review same or to advise Contractor of any deficiencies in such policies and endorsements, and such receipt shall not relieve Contractor from, or be deemed a waiver of, the Owner's rights to insist on strict fulfillment of Contractor's obligations under this Contract.

14.9 The insurance policies, except Workers' Compensation and Professional Liability, required by this Contract, shall name the Owner, it agents, officers, officials and employees as Additional Insured.

14.10 REQUIRED COVERAGE

14.10.1 COMMERCIAL GENERAL LIABILIITY

14.10.2 Contractor shall maintain Commercial General Liability insurance with a unimpaired limit of not **less than $1,000,000.00 for each occurrence with a $2,000,000.00 Products/Completed Operations Aggregate** and a **$2,000,000.00 General Aggregate Limit**. The policy shall include coverage for bodily injury, broad form property damage, personal injury, products and completed operations and blanket contractual coverage including, but not limited to, the liability assumed under the indemnification provisions of this Contract which coverage will be at least as broad as

Insurance Service Office, Inc. Policy Form CG 0001 or any replacements thereof. The coverage shall not exclude X,C,U.

14.10.3 Such policy shall contain a severability of interest provision, and shall not contain a sunset provision or commutation clause, or any provision which would serve to limit third party action over claims.

14.10.4 The Commercial General Liability additional insured endorsement shall be at least as broad as the Insurance Service Office, Inc., Additional Insured, CG 2010 (07/04), and CG 2037 (07/04) and shall include coverage for Contractor's operations and products and completed operations.

14.10.5 If required by this Contract, the Contractor subletting any part of the work, services or operations awarded to the Contractor shall purchase and maintain, at all times during prosecution of the work, services or operations under this Contract, an Owner and Contractor's Protective Liability insurance policy for bodily injury and property damage, including death, which may arise in the prosecution of this Contractor's work, service or operations under this Contract. Coverage shall be on an occurrence basis with **a limit not less than $2,000,000.00 per occurrence**, and the policy shall be issued by the same insurance company that issues the Contractor's Commercial General Liability insurance.

14.11 AUTOMOBILE LIABILITY

14.11.1 Contractor shall maintain Commercial/Business Automobile Liability insurance with a combined single limit for bodily injury and property damage of **not less than $2,000,000.00 each occurrence** with respect to the Contractor's any owned, hired, and non-owned vehicles assigned to or used in performance of the Contractor's work. Coverage will be at least as broad as coverage code 1, "any auto", (Insurance Service Office, Inc. Policy Form CA 0001, or any replacements thereof). Such insurance shall include coverage for loading and off loading hazards. If hazardous substances, materials or wastes are to be transported, MCS 90 endorsement shall be included and **$5,000,000.00 per accident limits for bodily injury and property damage** shall apply.

14.12 WORKER'S COMPENSATION

14.12.1 The Contractor shall carry Workers' Compensation insurance to cover obligations imposed by federal and state statutes having jurisdiction of Contractor's employees engaged in the performance of the work or services; and, Employer's Liability insurance of **not less than $1,000,000.00 for each accident, $1,000,000.00 disease for each employee**, and **$1,000,000.00 disease policy limit**.

14.12.2 In case any work is sub-contracted, the Contractor will require the Subcontractor to provide Workers' Compensation and Employer's Liability to at least the same extent as required of the Contractor.

14.13 CERTIFICATES OF INSURANCE

14.13.1 Prior to commencing work or services under this Contract, Contractor shall furnish the Owner with Certificates of Insurance, or formal endorsements as required by the Contract, issued by Contractor's insurer(s), as evidence that policies providing the required coverages, conditions and limits required by the Contract are in full force and effect.

14.13.2 In the event any insurance policy(ies) required by this Contract, is(are) written on a "claims made" basis, coverage shall extend for two years past completion and acceptance of the Contractor's work or services and as evidenced by annual Certificates of Insurance.

14.13.3 If a policy does expire during the life of the Contract, a renewal certificate must be sent to the Owner fifteen (15) days prior to the expiration date.

14.14 CANCELLATION AND EXPIRATION NOTICE

14.14.1 Insurance required herein shall not expire, be cancelled, or materially changed without thirty (30) days prior written notice to the Owner.

ARTICLE 15 - CHANGES IN THE WORK AND CLAIMS

15.1 CHANGE ORDERS

15.1.1 The Owner, without invalidating the Contract, may order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions. The Contract Amount and/or the Contract Time shall be adjusted pursuant to the terms of the Contract Documents.

15.1.2 A Change Order is a written amendment to the Contract Documents signed by the Owner, Engineer, and the Contractor, issued after the execution of the Contract, authorizing a Change in the Work or an adjustment in the Contract Amount or the Contract Time. The Contract amount and the Contract Time may be changed only by Change Order.

15.1.3 The cost or credit, as the case may be, to the Owner resulting from a Change in the Work shall be determined in one or more of the following ways as mutually agreed:

.1 by a lump sum properly itemized in a form acceptable to Engineer and Owner including sufficient supporting substantiating data to permit evaluation.
.2 by actual cost and the specified percentage fees covering overhead and profit, less applicable trade discounts, rebates, credits or other such reductions in cost made available to Contractor.
.3 Unit price as stated in the Contract, subject to the provisions of 15.1.5 herein. Unit prices proposed on the bid form and included in the Contract are not subject to further overhead and profit adjustments. The Contract sum will be adjusted by the direct extension of the number of units and unit price.

The amount of Contractor's overhead and profit allowed for any change order, whether increase or decrease shall not exceed the percentages of overhead and profit specified in Paragraph 3.5 hereof on work performed by Contractor; and the percentage for profit specified in Paragraph 3.5 hereof of Subcontractor's quotation on all work performed by Subcontractors for profit, with no markup for overhead. Subcontractor's markup on Change Orders shall be limited by their subcontracts with Contractor to the percentages of direct cost for overhead and for profit as specified in Paragraph 3.5. hereof.

15.1.4 If none of the methods set forth in Subparagraph 15.1.3 is agreed upon to calculate a charge or credit to Owner, the Contractor, provided he otherwise receives a Change Order, shall promptly proceed with the Work involved. The cost of such Work shall then be estimated in good faith by the Engineer on the basis of the Contractor's reasonable expenditures and savings, including, an allowance for overhead and profit as provided in 15.1.3. The Engineer shall use the unit price basis if available and, if not, then the actual cost basis for this determination. The Engineer shall then submit that estimate, with all supporting information, to Owner for approval. In such case, and also under Subparagraph 15.1.3.1 above, the Contractor shall keep and present, in such form as the Engineer may prescribe, an itemized accounting together with appropriate supporting data. The amount of credit to be allowed by the Contractor to the Owner for any deletion or change which results in a net decrease in cost will be the amount of the actual net decrease, including an allowance for overhead and profit, as confirmed by the Engineer. When both additional costs and credits are involved in any one change, the allowance for overhead and profit shall be figured on the basis of the net increase or decrease, if any.

15.1.5 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if the quantities originally contemplated are so changed in proposed Change Order that application of the agreed unit prices to the quantities or Work proposed will create a hardship on the Owner or the Contractor, the applicable unit prices shall be equitably adjusted to prevent such hardship.

15.1.6 If the Contractor claims that additional cost or time is involved because of:

.1 any written interpretation issued pursuant to Paragraph 4.11.5,
.2 any order by the Engineer or Owner to stop the Work pursuant to Paragraph 5.2.11 where the Contractor was not at fault, or
.3 any written order for a minor change in the Work issued pursuant to Paragraph 15.3, the Contractor shall make such claim as provided in Paragraph 15.2.

15.1.7 Impact costs. No claim for impact costs resulting from performance of a Change Order will be permitted against the Owner, Engineer or any other party in privacy of Contract with the Owner with respect to the project subsequent to the time that the Change Order is signed by the Contractor.

15.1.8 Final Settlement. Agreement on any Change Order shall constitute a final settlement of all matters relating to the change in the Work which is the subject of the Change Order,

including, but not limited to, all direct and indirect costs associated with such change, any impact such change may have on the unchanged Work, and any and all adjustments to the Contract Sum or the Contract Time. In the event a Change Order increases the Contract Sum, the Contractor shall include the Work covered by such Change Orders in Application for Payment as if such Work were originally part of the Contract or in separate notice as provided in 12.4.4. Agreement on any Change Order releases the Owner, and any other party in privacy of Contract with the Owner with respect to the Project from all claims or liabilities arising in any way in the connection with, or in any way associated with, such change.

15.2 CLAIMS FOR ADDITIONAL COST OR TIME

15.2.1 If the Contractor is entitled, under the terms of the Contract, to make a claim for an increase in the Contract Amount or any other claim, he shall give the Engineer and Owner written notice thereof within fourteen (14) days after the occurrence of the event giving rise to such claim or include such notice in the Application for Payment for the month in which the event giving rise to the claim occurred, whichever is earlier. Any notice other than one made for an extension of the Contract Time shall be given by the Contractor before proceeding to execute the Work which is the subject matter of the claim, except in an emergency endangering life or property, in which case the Contractor shall proceed in accordance with Paragraph 12.4.4 within the time limits prescribed herein and no such claim shall be valid unless so made. Any change in the Contract Amount or Contract Time resulting from such claim to be effective shall be approved by the Owner and authorized by Change Order.

15.3 MINOR CHANGES IN THE WORK

15.3.1 The Engineer or Owner shall have authority to order minor changes in the Work not involving an adjustment in the Contract Amount or an extension of the Contract Time and not inconsistent with the intent of the Contract Documents.

15.4 FIELD ORDERS

15.4.1 The Engineer or Owner may issue written Field Orders which interpret the Contract Documents or which order minor changes in the Work in accordance with Paragraph 15.3 without change in Contract Amount or Contract Time. The Contractor shall carry out such Field Orders promptly.

ARTICLE 16 - UNCOVERING AND CORRECTION OF WORK

16.1 UNCOVERING OF WORK

16.1.1 If any Work should be covered contrary to the request of the Engineer, it must, if required by the Engineer, be uncovered for his observation and replaced all at the Contractor's expense.

16.1.2 If any other Work has been covered which the Engineer has not requested to observe prior to being covered, the Engineer may request to see such Work and it shall be uncovered by the Contractor. If such Work is found to be in accordance with the Contract Documents, the cost of

uncovering and replacement after approval by the Owner shall, by appropriate Change Order, be charged to the Owner. If such Work is found not to be in accordance with the Contract Documents, the Contractor shall pay such costs unless it is found that this condition was caused by a separate contractor employed as provided in Article 9, and in that event the Owner shall be responsible for the payment of such costs.

16.2 CORRECTION OF WORK

16.2.1 The Contractor shall promptly correct all Work rejected by the Engineer as defective or as failing to conform to the Contract Documents whether observed before or after Final Completion and whether or not fabricated, installed or completed. The Contractor shall bear all costs of correcting such rejected Work, including the cost of the Engineer's additional services thereby made necessary.

16.2.2 If, within the time provided in Paragraph 18.1 herein or within such longer period of time as may be prescribed by law or by the terms of any applicable special guarantee required by the Contract Documents, including the original conformance with the Contractor Documents, any of the Work is found to be defective or not in accordance with the Contract Documents, the Contractor shall, at his sole expense, correct it promptly after receipt of a written notice from the Owner to do so. The Owner shall give such notice promptly after discovery of the condition.

16.2.3 All such defective or non-conforming Work under Paragraphs 16.2.1 and 16.2.2 shall be removed from the site where necessary, and the Work shall be corrected to comply with the Contract Documents without cost to the Owner.

16.2.4 The Contractor shall bear the cost of making good all work of separate contractors destroyed or damaged by such removal or correction.

16.2.5 If the Contractor does not remove such defective or non-conforming Work within a reasonable time fixed by written notice from the Engineer, the Owner may remove it and may store the materials or equipment at the expense of the Contractor. If the Contractor does not pay the cost of such removal and storage within ten (10) days after receipt of a statement of charges therefore, the Owner may, upon ten (10) additional days written notice, sell such Work at auction or at private sale and shall account for the net proceeds thereof after deducting all the costs that should have been borne by the Contractor, including compensation for additional Engineering services and any attorneys, fees incurred by Owner in connection therewith. If such proceeds of sale do not cover all costs that the Contractor should have borne, the difference shall be charged to the Contractor and an appropriate Change Order shall be issued. If the payments then or thereafter due the Contractor are not sufficient to cover such amount, the Contractor shall pay the difference to the Owner, and all attorneys, fees and other costs that the Owner may incur in collecting same.

16.2.6 If the Contractor fails to correct such defective or non-conforming work, the Owner may correct it in accordance with Paragraph 10.6.

16.2.7 The obligations of the Contractor under this Paragraph 16.2 shall be in addition to and not in limitation of any obligations imposed upon him by special guarantees required by the Contract Documents or otherwise prescribed by law.

16.3 ACCEPTANCE OF DEFECTIVE OR NON-CONFORMING WORK

If the Owner prefers to accept defective or non-conforming Work, he may do so instead of requiring its removal and correction, in which case a Change Order will be issued to reflect an appropriate reduction in the Contract Amount, or, if the amount is determined after final payment, it shall be paid by the Contractor.

ARTICLE 17 - TERMINATION OF THE CONTRACT

17.1 TERMINATION BY THE CONTRACTOR

17.1.1 If the work is stopped for a period of One Hundred and Sixty (160) days, and the Engineer and the Owner are immediately notified of such stopping, under an order of any court or other public authority having jurisdiction through no act or fault of the Contractor or any Subcontractor or their agents or employees or any other persons performing any of the Work under a contract with the Contractor, and by reason of some act or omission of Owner, then the Contractor may, upon seven day's written notice to the Owner and the Engineer as its sole remedy hereunder, terminate the Contract and recover from the Owner payment for all Work approved by Owner and for any proven loss sustained upon any materials, including reasonable profit for Work accomplished through the date the notice of termination is given and approved and accepted by Owner.

17.2 TERMINATION BY THE OWNER

17.2.1 If, through any cause, the Contractor shall fail to fulfill in a timely and proper manner the Contractor's obligations under this Contract, or if the Contractor shall violate any of the covenants, agreements, or stipulations of the Contract, the Owner shall thereupon have the right to terminate this Contract by giving written notice to the Contractor of such termination and specifying the effective date thereof, at least five (5) days before the effective date of such termination. In such event, all finished or unfinished documents, data, studies, surveys, drawings, maps, models, photographs and reports prepared by the Contractor under this Contract shall, at the option of the Owner, become its property and the Contractor shall be entitled to receive just and equitable compensation for any work satisfactorily completed hereunder.

17.2.2 Notwithstanding the above, the Contractor shall not be relieved of liability to the Owner for damages sustained by the Owner by virtue of any breach of the Contract by the Contractor, and the Owner may withhold any payments to the Contractor for the purpose of set-off until such time as the exact amount of damages due the Owner from the Contractor is determined.

17.2.3 The Owner may terminate this Contract at any time by giving at least (10) days notice in writing to the Contractor. If the Contract is terminated by the Owner, the Contractor will be paid for the time provided and expenses incurred up to the termination date. If this Contract is terminated due to the fault of the Contractor, the aforementioned clause relative to termination shall apply.

17.2.4 If the Contractor refuses or fails, except in cases for which extension of time is provided, to supply enough properly skilled workmen or sufficient and proper materials to complete the Work in accord with the Progress Schedule and Contract Time, or he fails to make prompt payments to Subcontractors or for materials or labor, or disregards laws, ordinances, rules, regulations or orders of any public authority having jurisdiction, or fails to uninterruptedly complete the Work once he has the Notice to Proceed, or otherwise is guilty of a material breach of any provision of the Contract Documents, then the Owner may, without prejudice to any other right or remedy and after giving the Contractor and his surety seven (7) days written notice, terminate the employment of the Contractor and take possession of the site and all materials, and may finish the Work by whatever method he may deem expedient. In such case, the Contractor shall not be entitled to receive any further payment until the Work is finished. Termination of the Contract under this Paragraph shall not relieve the Contractor of any warranty obligations on Work performed hereunder, and such obligations shall survive termination of this Contract.

17.2.5 If the unpaid balance of the Contract Amount is exceeded by the costs of finishing the Work, including compensation for the Engineer's additional services, attorneys' fees and all other costs incurred by Owner in completion of the Contractor's obligations, the Contractor shall pay the difference to the Owner. The costs incurred by the Owner as herein provided shall be certified by the Engineer.

17.2.6 Pursuant to A.R.S. § 38-511, OWNER reserves the right to cancel this Agreement, within three years after the effective date of this Agreement, without penalty or further obligation, if any person significantly involved in initiating, negotiating, securing, drafting or creating the Agreement on behalf of OWNER is, at any time while this Agreement or any extension of this Agreement is in effect, an employee or agent of CONTRACTOR in any capacity or a sub-contractor to CONTRACTOR with respect to the subject matter of this Agreement. Cancellation under this section by OWNER shall be effective when written notice from the City Manager is received by CONTRACTOR. The OWNER may recoup any fee or commission paid or due to any person significantly involved in initiating, negotiating, securing, drafting or creating the Agreement on behalf of the OWNER from CONTRACTOR arising as the result of the Agreement.

ARTICLE 18 - WARRANTY AND SITE CONDITIONS

18.1 TWO-YEAR WARRANTY

18.1.1 The Contractor shall warrant all Work under this Contract to be in accordance with the Contract Documents against defects of material and workmanship for a period of two

years from the date of Final Completion; provided, however, that those items of the Work specified as having longer warranties shall be warranted for the period specified.

18.1.1.1 The Contractor shall be responsible for the total cost of repairing and restoring any Work found not in compliance with the Contract Documents or any defective Work to a new condition, at no cost to Owner.

18.1.1.2 In any case where the subject matter of the non-compliance or defect relates to Work done under a subcontract between the Contractor and any subcontractor, it is the responsibility of the Contractor, not the Owner, to secure the Subcontractor's performance in compliance with this paragraph and, in the event of the Subcontractor's failure or refusal within a reasonable time to perform after notice, it shall be the Contractor's responsibility to repair and restore such non-complying or defective Work to a new condition, at no cost to Owner.

18.1.1.3 In any case where the failure in complying or defective Work has been brought to the attention of the Contractor by the Owner and the Contractor fails or refuses to correct it within five (5) days of such notice, the Owner may elect, without precluding any other remedy it may have available to it, to have the defective Work repaired and restored to a new condition in whatever reasonable manner it deems appropriate, regardless of the cost, and the Contractor shall be liable to the Owner for the total cost thereof, including, by way of example only, any Engineering and legal fees related to effecting the repair, plus 10% of the total costs incurred.

18.1.2 Material and workmanship made good through compliance with such warranty shall be subject to the same warranty period as the original materials and workmanship. Such warranty period shall begin on the date the replaced material and work is certified as acceptable in writing by the Engineer.

18.2 SANITATION

18.2.1 The Contractor shall provide temporary sanitation facilities for the use of employees on this construction. Following the period of necessity for such facilities, they shall be removed and all evidence thereof effaced.

18.3 JOB OFFICE

18.3.1 A job office as approved by the Engineer shall be provided on the project site. The Contractor shall install at his own expense a job telephone for use of all trades in connection with the work and shall pay for all local calls. All long-distance calls and toll calls shall be paid for by the person making the call.

18.4 USE OF PREMISES

18.4.1 The Contractor shall confine his equipment and plant, the storage of materials, and the operations of his workmen to limits indicated by law, ordinances, permits, or directions of the Engineer and shall not unreasonably encumber the premises with materials or equipment.

18.4.2 The Contractor shall enforce the Engineer's instructions regarding signs, advertisement, fires, and smoking.

18.5 SEVERABILITY

18.5.1 In the event any provision in this Contract is held invalid by any court of competent jurisdiction, the remaining provisions in this Contract shall be deemed severable and shall remain in full force and effect.

ARTICLE 19 - RECORDS ACCESS AND RETENTION REQUIREMENTS

19.1 Records Retention: The Contractor shall maintain and shall contractually require each subcontractor to maintain accounts and records including personnel, property and financial records adequate to identify and account for all costs pertaining to the Contract and such other records as may be deemed necessary by the Owner to assure proper accounting for all project funds both Federal and non-Federal shares. These records will be retained for five (5) years after the expiration of this Contract unless permission to destroy them is granted in writing by the Owner.

19.2 Access to Records: Legible copies of all records maintained by the Contractor shall be made available, upon request, to the Owner and any other body authorized by the Owner.

ARTICLE 20 - COMPLIANCE WITH IMMIGRATION LAWS and E-VERIFY REQUIREMENT

20.1 As mandated by Arizona Revised Statutes ("A.R.S.") Section 41-4401, the Owner is prohibited from awarding a contract to any contractor or subcontractor that fails to comply with A.R.S. Section 23-214(A). (That subsection reads: "After December 31, 2007, every employer, after hiring an employee, shall verify the employment eligibility of the employee through the E-Verify program.) The Owner must also ensure that every contractor and subcontractor complies with federal immigration laws and regulations that relate to their employees and A.R.S. Section 23-214(A). Therefore, in signing or performing any Contract (including this Agreement) for the Owner, the Contractor fully understands that:

a. It warrants that both it and any subcontractors it may use comply with all federal immigration laws and regulations that relate to their employees and their compliance with A.R.S. Section 23-214(A);

b. A breach of the warranty regarding compliance with immigration laws and regulations shall be deemed a material breach of the Contract that is subject to penalties up to and including termination of the Contract; and

c. The Owner or its designee retains the legal right to inspect the papers or any contractor or subcontractor employee who works on the Contract to ensure that the contractor or subcontractor is complying with the warranty under paragraph (a).

ARTICLE 21 - SCRUTINIZED BUSINESS OPERATIONS

21.1 Pursuant to A.R.S. Section 35-391.06 and 35-393.06, the contractor certifies that it does not have a scrutinized business operation in Sudan or Iran. For the purpose of this Section the term "scrutinized business operations" shall have the meanings set forth in A.R.S. Section 35-391 and/or 35-393 as applicable. If the Owner determines that the contractor submitted a false certification, the Owner may impose remedies as provided by law including termination of this Contract.

IN WITNESS WHEREOF, three (3) identical counterparts of this Agreement, each of which shall for all purposes be deemed original thereof, have been duly executed by the Parties herein above named, on the day and year first above written.

OWNER – City of Bisbee:

By: _____
A.Z. Badal, Mayor, City of Bisbee

Date: July 1, 2014

Attest: Ashlee Coronado
Ashlee Coronado, Clerk

APPROVED AS TO FORM:

By: _____
John A. MacKinnon, Attorney

Date: 7/1/14

CONTRACTOR:

By: _____
Craig Alan Floyd, Operations Manager, PCI

Date: 06/18/14

END OF CONTRACT

EJCDC
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

NOTICE TO PROCEED

Owner:	City of Bisbee	Owner's Contract No.:	CW 013-2013A
Contractor:	Performance Contracting, Inc.	Contractor's Project No.:	
Engineer:	Pacific Advanced Civil Engineering, Inc.	Engineer's Project No.:	A364
Project:	San Jose WWTP Site Preparation for Solar Power Generation System	Contract Name:	CW 013-2013A San Jose WWTP Photovoltaic (PV) Solar Power Generation System
		Effective Date of Contract:	June 18, 2014

TO CONTRACTOR:

Owner hereby notifies Contractor that the Contract Times under the above Contract will commence to run on June 23, 2014 with onsite work commencing on July 23, 2014.

On July 23, 2014, Contractor shall start performing its obligations under the Contract Documents. No Work shall be done at the Site prior to such date. In accordance with the Agreement, the date of Substantial Completion is October 11, 2014, and the date of readiness for final payment is 120 days from the contract commencement

Before starting any Work at the Site, Contractor must comply with the following:
N/A

Owner:

Authorized Signature

By: Thomas J. Klimek
Title: Public Works Director
Date Issued: 6/18/14

Copy: Engineer

EJCDC

NOTICE OF AWARD

Date of Issuance: June 17, 2014

Owner:	City of Bisbee	Owner's Contract No.:	CW 013-2013A
Engineer:	Pacific Advanced Civil Engineering, Inc.	Engineer's Project No.:	A364
Project:		Contract Name:	San Jose WWTP Photovoltaic (PV) Solar Power Generation System

Bidder: Performance Contracting, Inc.

Bidder's Address: 4401 Freidrich Lane, Suite 306, Austin TX, 78744

TO BIDDER:

You are notified that Owner has accepted your Bid dated May 16, 2014 for the above Contract, and that you are the Successful Bidder and are awarded a Contract for: CW 013-2013A San Jose WWTP Photovoltaic (PV) Solar Power Generation System.

The work of this project comprises of installing photovoltaic modules and general electric work at the existing City of Bisbee San Jose Wastewater Treatment Plant. The modifications and improvements shall include, but are not limited to the following:

- *All work on this project will be coordinated with the City's Engineer and WWTP Operational staff to ensure that the WWTP can continue to operate. Existing equipment shall not be taken out of service until all prerequisite work is installed and new equipment has arrived and is ready for installation. Contractor shall make all effort to minimize process downtime.*
- *Installation of a new 400 kW DC photovoltaic system including structural, mechanical, electrical and controls;*
- *Installation of area lighting and electrical work as shown within the Contract Documents*
- *APS coordination for the interconnection application agreement, etc.*

This work shall be completed in conjunction with project CW 013-2013B San Jose WWTP Site Preparation for Solar Power Generation System.

The Contract Price of the awarded Contract is: $ 1,039,349.

Unexecuted counterparts of the Agreement accompany this Notice of Award, and one copy of the Contract Documents accompanies this Notice of Award, or has been transmitted or made available to Bidder electronically.

☐ a set of the Drawings will be delivered separately from the other Contract Documents.

You must comply with the following conditions precedent within 15 days of the date of receipt of this Notice of Award:

1. Deliver to Owner one (1) counterparts of the Agreement, fully executed by Bidder.
2. Deliver with the executed Agreement(s) the Contract security *[e.g., performance and payment bonds]* and insurance documentation as specified in the Instructions to Bidders and General Conditions.
3. Other conditions precedent (if any): N/A

Failure to comply with these conditions within the time specified will entitle Owner to consider you in default, annul this Notice of Award, and declare your Bid security forfeited.

EJCDC

Within ten days after you comply with the above conditions, Owner will return to you one fully executed counterpart of the Agreement, together with any additional copies of the Contract Documents as indicated in the General Conditions.

Owner:

Authorized Signature

By: Thomas J. Klimek

Title: Public Works Director

Copy: Engineer

EJCDC
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

NOTICE OF AWARD

Date of Issuance:

Owner: Owner's Contract No.:

Engineer: Engineer's Project No.:

Project: Contract Name:

Bidder:

Bidder's Address:

TO BIDDER:

You are notified that Owner has accepted your Bid dated [_____] for the above Contract, and that you are the Successful Bidder and are awarded a Contract for:

_____.

[describe Work, alternates, or sections of Work awarded]

The Contract Price of the awarded Contract is: $_____ *[note if subject to unit prices, or cost-plus]*

[ ] unexecuted counterparts of the Agreement accompany this Notice of Award, and one copy of the Contract Documents accompanies this Notice of Award, or has been transmitted or made available to Bidder electronically. *[revise if multiple copies accompany the Notice of Award]*

☐ a set of the Drawings will be delivered separately from the other Contract Documents.

You must comply with the following conditions precedent within 15 days of the date of receipt of this Notice of Award:

1. Deliver to Owner [____]counterparts of the Agreement, fully executed by Bidder.
2. Deliver with the executed Agreement(s) the Contract security *[e.g., performance and payment bonds]* and insurance documentation as specified in the Instructions to Bidders and General Conditions, Articles 2 and 6.
3. Other conditions precedent (if any):

Failure to comply with these conditions within the time specified will entitle Owner to consider you in default, annul this Notice of Award, and declare your Bid security forfeited.

Within ten days after you comply with the above conditions, Owner will return to you one fully executed counterpart of the Agreement, together with any additional copies of the Contract Documents as indicated in Paragraph 2.02 of the General Conditions.

Owner:

Authorized Signature

By:

Title:

Copy: Engineer

EJCDC
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

NOTICE TO PROCEED

Owner:	Owner's Contract No.:
Contractor:	Contractor's Project No.:
Engineer:	Engineer's Project No.:
Project:	Contract Name:
	Effective Date of Contract:

TO CONTRACTOR:

Owner hereby notifies Contractor that the Contract Times under the above Contract will commence to run on [_____, 20__]. *[see Paragraph 4.01 of the General Conditions]*

On that date, Contractor shall start performing its obligations under the Contract Documents. No Work shall be done at the Site prior to such date. In accordance with the Agreement, [the date of Substantial Completion is _____, and the date of readiness for final payment is_____] ***or*** [the number of days to achieve Substantial Completion is _____, and the number of days to achieve readiness for final payment is _____].

Before starting any Work at the Site, Contractor must comply with the following:
[Note any access limitations, security procedures, or other restrictions]

Owner:

Authorized Signature

By:

Title:

Date Issued:

Copy: Engineer

CERTIFICATE OF LIABILITY INSURANCE

4/1/2015

DATE (MM/DD/YYYY): 6/10/2014

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER
Lockton Companies
444 W. 47th Street, Suite 900
Kansas City MO 64112-1906
(816) 960-9000

CONTACT NAME:
PHONE (A/C, No, Ext):
FAX (A/C, No):
E-MAIL ADDRESS:

INSURER(S) AFFORDING COVERAGE	NAIC #
INSURER A : Arch Insurance Company	11150
INSURER B : First Specialty Insurance Corporation	34916
INSURER C : *INCLUDES USL&H	
INSURER D :	
INSURER E :	
INSURER F :	

INSURED
852
PERFORMANCE CONTRACTING, INC.
ISSD 01-01-19
4401 FREIDRICH LANE - BLDG 3, SUITE 306
AUSTIN TX 78744

COVERAGES **CERTIFICATE NUMBER:** 12979331 **REVISION NUMBER:** XXXXXXX

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	X COMMERCIAL GENERAL LIABILITY	Y	Y	41GPP8895503	4/1/2014	4/1/2015	EACH OCCURRENCE	$ 1,000,000
	[ ] CLAIMS-MADE [X] OCCUR						DAMAGE TO RENTED PREMISES (Ea occurrence)	$ 300,000
	X CONTRACTUAL; XCU						MED EXP (Any one person)	$ 10,000
	X CROSS LIABILITY/EIFS						PERSONAL & ADV INJURY	$ 1,000,000
	GEN'L AGGREGATE LIMIT APPLIES PER:						GENERAL AGGREGATE	$ 2,000,000
	[ ] POLICY [X] PRO-JECT [ ] LOC						PRODUCTS - COMP/OP AGG	$ 2,000,000
	OTHER:							$
A	AUTOMOBILE LIABILITY	Y	Y	41CAB8895603 (AOS)	4/1/2014	4/1/2015	COMBINED SINGLE LIMIT (Ea accident)	$ 2,000,000
A	X ANY AUTO			41CAB8895703 (MA)	4/1/2014	4/1/2015	BODILY INJURY (Per person)	$ XXXXXXX
	X ALL OWNED AUTOS [ ] SCHEDULED AUTOS						BODILY INJURY (Per accident)	$ XXXXXXX
	X HIRED AUTOS [X] NON-OWNED AUTOS						PROPERTY DAMAGE (Per accident)	$ XXXXXXX
	X Contractual							$ XXXXXXX
B	[ ] UMBRELLA LIAB [X] OCCUR	Y	Y	IRE200027101	4/1/2014	4/1/2015	EACH OCCURRENCE	$ 5,000,000
B	X EXCESS LIAB [ ] CLAIMS-MADE			(FOLLOW FORM)			AGGREGATE	$ 5,000,000
	DED [X] RETENTION $ 10,000						Products Com/Op	$ 5,000,000
A	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY Y/N		N	41WCI8895403	4/1/2014	4/1/2015	X PER STATUTE [ ] OTH-ER	
A	ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? [N] N/A			*[AOS & WA (USL&H)] EXCLUDES MONOPOLISTIC STATES			E.L. EACH ACCIDENT	$ 1,000,000
A	(Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below						E.L. DISEASE - EA EMPLOYEE	$ 1,000,000
							E.L. DISEASE - POLICY LIMIT	$ 1,000,000
A	EMPLOYERS LIABILITY (STOP GAP)	N	N	41GPP8895503	4/1/2014	4/1/2015	$1,000,000 EA. ACC/EA EMPL. DISEASE & POLICY LIMIT - INCLUDES ALL MONOPOLISTIC STATES	

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)
FOR CANCELLATION, THE INSURER(S) WILL SEND 30 DAYS NOTICE OF CANCELLATION AND WILL SEND 10 DAYS NOTICE FOR NONPAYMENT OF PREMIUM TO THE CERTIFICATE HOLDER LISTED BELOW. City of Bisbee WWTP Photovoltaic Solar Power Generation System Project No. CW 013-2013A IS/ARE ADDED AS ADDITIONAL INSURED ON A PRIMARY AND NON-CONTRIBUTORY COVERAGE BASIS AS RESPECTS LIABILITY COVERAGE AND SUBROGATION IS WAIVED AS RESPECTS GL, AUTO, EXCESS AND/OR UMBRELLA FOR THIS PROJECT AS PERMITTED BY STATE. INSURANCE SHOWN APPLIES ONLY TO EXTENT OF WRITTEN CONTRACT.

CERTIFICATE HOLDER

12979331
City of Bisbee
118 Arizona Street
Bisbee AZ 85603

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

Water Infrastructure Finance Authority of Arizona
Clean Water Revolving Fund
Drinking Water Revolving Fund

CONTRACT PACKET for Governmental Borrowers

This packet lists required contract conditions that apply to all Clean Water and Drinking Water Revolving Fund projects and contains forms that must be used in the procurement process. Please review this packet prior to bidding.

PLEASE NOTE

- **This packet, in its entirety, must be physically included in all bidding, solicitation and contract documents.**
- Federal Davis-Bacon prevailing wages apply to this project. Payment of the wages, fringe benefits and overtime rates is required.
- The appropriate Federal (Davis-Bacon) Prevailing Wage Decision must be physically incorporated into the bidding and contract documents.
- The construction category of Heavy (excluding dam construction) should typically be applied to all projects funded by WIFA. If you believe that a different category of wages, such as Building, should be applied to your project or portions of your project, please contact WIFA in advance.
- Weekly certified payroll submittal is required under the Federal Davis-Bacon laws.
- Compliance with the Civil Rights Act and Equal Employment Opportunity is required.
- Promotion of Small, Minority and Women-owned Businesses and participation in EPA's Disadvantaged Business Enterprise (DBE) Program is required.

Water Infrastructure Finance Authority of Arizona
Clean Water Revolving Fund
Drinking Water Revolving Fund

Required Contract Conditions

This project is being financed in whole or in part by the Water Infrastructure Finance Authority of Arizona through the Clean Water or Drinking Water Revolving Fund. The loan recipient is required to comply with the following federal and state laws, rules and regulations and must ensure that their contractor(s) also comply(ies) with these regulations, laws and rules.

1. (i) Title VI of the Civil Rights Act of 1964 (Pub. L. 88-352, 42 U.S.C. Sec. 2000d), (ii) the Rehabilitation Act of 1973 (Pub. L. 93-1123, 87 Stat. 355, 29 U.S.C. Sec. 794), (iii) the Age Discrimination Act of 1975 (Pub. L. 94-135 Sec. 303, 89 Stat. 713, 728, 42 U.S.C. Sec. 6102), (iv) Section 13 of the Federal Water Pollution Control Act (Pub. L. 92-500, 33 U.S.C. Sec. 1251), and subsequent regulations, ensures access to facilities or programs regardless of race, color, national origin, sex, age or handicap.

2. Equal Employment Opportunity (Executive Order 11246, as amended by Executive Orders 11375 and 12086 and subsequent regulations). Prohibits employment discrimination on the basis of race, color, religion, sex or national origin. Inclusion of the seven clauses in Section 202 of Executive Order 11246 as amended by Executive Orders 11375 and 12086 are required in all project related contracts and subcontracts over $10,000.

3. (i) Promoting the use of Small, Minority, and Women-owned Businesses (Executive Orders 11625, 12138 and 12432), (ii) Small Businesses Reauthorization & Amendment Act of 1988 (Section 129 of Pub. L. 100-590), (iii) Department of Veterans Affairs and Housing and Urban Development, and Independent Agencies Appropriations Act, 1993 (Pub. L. 102-389, 42 U.S.C. Sec. 437d), and (iv) Title X of the Clean Air Acts Amendments of 1990 (Pub. L. 101-549, 42 U.S.C. Sec. 7601 note) ("EPA's 10% statute"). Encourages recipients to award construction, supply and professional service contracts to minority and women's business enterprises (MBE/WBE) and small businesses and requires recipients to utilize affirmative steps in procurement.

4. Participation by Disadvantaged Business Enterprises in Procurement under Environmental Protection Agency (EPA) Financial Assistance Agreements (40 C.F.R. Part 33).

5. Debarment and Suspension (Executive Order 12549). Prohibits entering into contracts or sub-contracts with individuals or businesses who are debarred or suspended. Borrowers are required to check the status of all contractors (construction and professional services) and must require contractors to check the status of subcontractors for contracts expected to be equal to or over $25,000 via this Internet address: www.sam.gov/portal/public/SAM.

6. E-Verify (A.R.S. § 41-4401). A governmental entity shall not award a contract to any contractor or subcontractor that fails to comply with A.R.S. § 23-214(A). Every government entity shall (i) ensure that every government entity contractor and subcontractor complies with the federal immigration laws and regulations that relate to their employees and A.R.S. § 23-214(A); (ii) require that every government entity contract include the required provisions listed under A.R.S. § 41-4401(A); and (iii) establish procedures to conduct random verification of the employment records of government entity contractors and subcontractors.

Water Infrastructure Finance Authority of Arizona
Clean Water Revolving Fund
Drinking Water Revolving Fund

Davis-Bacon Contract Conditions (Federal Prevailing Wages)

PLEASE NOTE: Federal Davis-Bacon prevailing wages apply to this project. Payment of the wages, fringe benefits and overtime rates is required.

The "subrecipient" referred to throughout the Davis-Bacon contract conditions is the WIFA Borrower.

"WIFA" is the Water Infrastructure Finance Authority of Arizona, State Capitalization Grant recipient, recipient, or the Authority.

Wage Rate Requirements
(Also referred to as Attachment 6)

Preamble

With respect to the Clean Water and Drinking Water State Revolving Funds, EPA provides capitalization grants to each State which in turn provides subgrants or loans to eligible entities within the State. Although EPA and the State remain responsible for ensuring subrecipients' compliance with the wage rate requirements set forth herein, those subrecipients shall have the primary responsibility to maintain payroll records as described in Section 3(3)(ii)(A) below and for compliance as described in Section 5.

Requirements for Subrecipients That Are Governmental Entities:
The following terms and conditions specify how recipients will assist EPA in meeting its Davis-Bacon (DB) responsibilities with respect to State recipients and subrecipients that are governmental entities. If a subrecipient has questions regarding when DB applies, obtaining the correct DB wage determinations, DB provisions, or compliance monitoring, it may contact the State recipient. If a State recipient needs guidance, the recipient will contact EPA. The recipient or subrecipient may also obtain additional guidance from DOL's web site at http://www.dol.gov/whd/recovery/index.htm.

1. Applicability of the Davis-Bacon prevailing wage requirements.
Davis-Bacon prevailing wage requirements apply to the construction, alteration, and repair of treatment works carried out in whole or in part with assistance made available by a Clean Water Revolving Fund and to any construction project carried out in whole or in part by assistance made available by a Drinking Water Revolving Fund. If a subrecipient encounters a unique situation at a site that presents uncertainties regarding DB applicability, the subrecipient must discuss the situation with the State recipient before authorizing work on that site.

2. Obtaining Wage Determinations.

(a) Subrecipients shall obtain the wage determination for the locality in which a covered activity subject to DB will take place prior to issuing requests for bids, proposals, quotes or other methods for soliciting contracts (solicitation) for activities subject to DB. These wage determinations shall be incorporated into solicitations and any subsequent contracts. Prime contracts must contain a provision requiring that subcontractors follow the wage determination incorporated into the prime contract.

(i) While the solicitation remains open, the subrecipient shall monitor www.wdol.gov weekly to ensure that the wage determination contained in the solicitation remains current. The subrecipient shall amend the solicitation if DOL issues a modification more than 10 days prior to the closing date (i.e. bid opening) for the solicitation. If DOL modifies or supersedes the applicable wage determination 10 days or less prior to the closing date, the subrecipient may request a finding from the State recipient that there is not a reasonable time to notify interested contractors of the modification of the wage determination. The State recipient will provide a report of its findings to the subrecipient.

(ii) If the subrecipient does not award the contract within 90 days of the closure of the solicitation, any modifications or supersedes DOL makes to the wage

determination contained in the solicitation shall be effective unless the State recipient, at the request of the subrecipient, obtains an extension of the 90 day period from DOL pursuant to 29 CFR 1.6(c)(3)(iv). The subrecipient shall monitor www.wdol.gov on a weekly basis if it does not award the contract within 90 days of closure of the solicitation to ensure that wage determinations contained in the solicitation remain current.

(b) If the subrecipient carries out activity subject to DB by issuing a task order, work assignment or similar instrument to an existing contractor (ordering instrument) rather than by publishing a solicitation, the subrecipient shall insert the appropriate DOL wage determination from www.wdol.gov into the ordering instrument. Typically, the appropriate wage determination would be the one in effect on the date the task order, work assignment or similar instrument is awarded.

(c) Subrecipients shall review all subcontracts subject to DB entered into by prime contractors to verify that the prime contractor has required its subcontractors to include the applicable wage determinations.

(d) As provided in 29 CFR 1.6(f), DOL may issue a revised wage determination applicable to a subrecipient's contract after the award of a contract or the issuance of an ordering instrument if DOL determines that the subrecipient has failed to incorporate a wage determination or has used a wage determination that clearly does not apply to the contract or ordering instrument. If this occurs, the subrecipient shall either terminate the contract or ordering instrument and issue a revised solicitation or ordering instrument or incorporate DOL's wage determination retroactive to the beginning of the contract or ordering instrument by change order. The subrecipient's contractor must be compensated for any increases in wages resulting from the use of DOL's revised wage determination.

3. Contract and Subcontract provisions.

The recipient shall insure that the subrecipient(s) shall insert in full in any contract in excess of $2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a treatment work under the CWSRF or a construction project under the DWSRF financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the acts listed in 29 CFR § 5.1, the following clauses:

(1) Minimum wages.

(i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: provided that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

Subrecipients may obtain wage determinations from the U.S. Department of Labor's web site, www.dol.gov.

(ii)(A) The subrecipient(s), on behalf of EPA, shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The State award official shall approve a request for an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the subrecipient(s) agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), documentation of the action taken and the request, including the local wage determination shall be sent by the subrecipient(s) to the State award official. The State award official will transmit the request, to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210 and to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification request within 30 days of receipt and so advise the State award official or will notify the State award official within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the subrecipient(s) do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the award official shall refer the request and the local wage determination, including the views of

all interested parties and the recommendation of the State award official, to the Administrator for determination. The request shall be sent to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt of the request and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii)(B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, provided that the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(2) Withholding. The subrecipient(s), shall upon written request of the EPA Award Official or an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the recipient may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) Payrolls and basic records.

(i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the

contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly, for each week in which any contract work is performed, a copy of all payrolls to the subrecipient, that is, the entity that receives the sub-grant or loan from the State capitalization grant recipient. Such documentation shall be available on request of the State recipient or EPA. As to each payroll copy received, the subrecipient shall provide written confirmation in a form satisfactory to the State indicating whether or not the project is in compliance with the requirements of 29 CFR 5.5(a)(1) based on the most recent payroll copies for the specified week. The payrolls shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on the weekly payrolls. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at www.dol.gov/whd/forms/wh347instr.htm or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the subrecipient(s) for transmission to the State or EPA if requested by EPA, the State, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the subrecipient(s).

(B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under § 5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under § 5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the State, EPA or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency or State may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) Apprentices and trainees -

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the Apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency

recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

(5) Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the EPA determines may by appropriate, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(7) Contract termination; debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and subrecipient(s), the State recipient, EPA, the U.S. Department of Labor, or the employees or their representatives.

(10) Certification of eligibility.

(i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

4. Contract Provision for Contracts in Excess of $100,000.

(a) Contract Work Hours and Safety Standards Act. The subrecipient shall insert the following clauses set forth in paragraphs (a)(1), (2), (3), and (4) of this section in full in any contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by Item 3 above or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of 40 hours in such workweek unless such

laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of 40 hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (a)(1) of this section the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (a)(1) of this section, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of 40 hours without payment of the overtime wages required by the clause set forth in paragraph (a)(1) of this section.

(3) Withholding for unpaid wages and liquidated damages. The subrecipient, upon written request of the EPA Award Official or an authorized representative of the Department of Labor, shall withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b)(2) of this section.

(4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (a)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (a)(1) through (4) of this section.

(b) In addition to the clauses contained in Item 3 above, in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in 29 CFR 5.1, the subrecipient shall insert a clause requiring that the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Further, the subrecipient shall insert in any such contract a clause providing that the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the recipient and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job.

5. Compliance Verification

(a) The subrecipient shall periodically interview a sufficient number of employees entitled to DB prevailing wages (covered employees) to verify that contractors or subcontractors are paying the appropriate wage rates. As provided in 29 CFR 5.6(a)(6), all interviews must be conducted in confidence. The subrecipient must use WIFA's interview form, Department of Labor's Standard Form 1445, or equivalent documentation to memorialize the interviews. WIFA's interview form and instructions are included with this packet.

(b) The subrecipient shall establish and follow an interview schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. Subrecipients must conduct more frequent interviews if the initial interviews or other information indicated that there is a risk that the contractor or subcontractor is not complying with DB. Subrecipients shall immediately conduct interviews in response to an alleged violation of the prevailing wage requirements. All interviews shall be conducted in confidence.

(c) The subrecipient shall periodically conduct spot checks of a representative sample of weekly payroll data to verify that contractors or subcontractors are paying the appropriate wage rates. The subrecipient shall establish and follow a spot check schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, if practicable, the subrecipient should spot check payroll data within two weeks of each contractor or subcontractor's submission of its initial payroll data and two weeks prior to the completion date the contract or subcontract. Subrecipients must conduct more frequent spot checks if the initial spot check or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. In addition, during the examinations the subrecipient shall verify evidence of fringe benefit plans and payments thereunder by contractors and subcontractors who claim credit for fringe benefit contributions.

(d) The subrecipient shall periodically review contractors and subcontractors use of apprentices and trainees to verify registration and certification with respect to apprenticeship and training programs approved by either the U.S Department of Labor or a state, as appropriate, and that contractors and subcontractors are not using disproportionate numbers of laborers, trainees and apprentices. These reviews shall be conducted in accordance with the schedules for spot checks and interviews described in Item 5(b) and (c) above.

(e) Subrecipients must immediately report potential violations of the DB prevailing wage requirements to the EPA DB contact listed below and to the appropriate DOL Wage and Hour District Office listed at www.dol.gov/whd.

Joe Ochab, EPA Region 9, 75 Hawthorne St. (P-22), San Francisco, CA 94105

Clean Water Revolving Fund
Drinking Water Revolving Fund

Equal Employment

Inclusion of these seven clauses (excerpt from Executive Order No. 11246, Section 202 as amended by Executive Order 11375 and 12086) is required in all CWRF and DWRF project related contracts and subcontracts over $10,000:

During the performance of this contract, the contractor agrees as follows:

(1) The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the contracting officer setting forth the provisions of this nondiscrimination clause.

(2) The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(3) The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the agency contracting officer, advising the labor union or worker's representative of the contractor's commitments under Section 202 of Executive Order No. 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The contractor will comply with all provisions of Executive Order No. 11246 of Sept. 24, 1965, and all of the rules, regulations, and relevant orders of the Secretary of Labor.

(5) The contractor will furnish all information and reports required by Executive Order No. 11246 of Sept. 24, 1965, and by the rules, regulations and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the contracting agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(6) In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of such rules, regulations, or orders, this contract may be cancelled, terminated or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts in accordance with procedures authorized in

Executive Order No. 11246 of Sept. 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order No. 11246 of Sept. 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(7) The contractor will include the provisions of paragraphs (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of Sept. 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as may be directed by the Secretary of Labor as a means of enforcing such provisions including sanctions for noncompliance: provided, however, that in the event the contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction, the contractor may request the United States to enter into such litigation to protect the interests of the United States.

Water Infrastructure Finance Authority of Arizona
Clean Water Revolving Fund
Drinking Water Revolving Fund

Disadvantaged Business Enterprises (DBE)

Good Faith Efforts

Borrowers and their prime contractors must follow, document, and maintain documentation of their good faith efforts as listed below to ensure that Certified Disadvantaged Business Enterprises* (DBEs) have the opportunity to participate in the project by increasing DBE awareness of procurement efforts and outreach.

1. Ensure DBEs are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities; including placing DBEs on solicitation lists and soliciting them whenever they are potential sources.
2. Make information on forthcoming opportunities available to DBEs and arrange time frames for contracts and establish delivery schedules, where the requirements permit, in a way that encourages and facilitates participation by DBEs in the competitive process. This includes, whenever possible, posting solicitation for bids or proposals for a minimum of 30 calendar days before the bid or proposal closing date.
3. Consider in the contracting process whether firms competing for large contracts could be subcontracted with DBEs. This will include dividing total requirements when economically feasible into smaller tasks or quantities to permit maximum participation by DBEs in the competitive process.
4. Encourage contracting with a consortium of DBEs when a contract is too large for one of these firms to handle individually.
5. Use the services and assistance of the Small Business Administration and the Minority Business Development Agency of the U. S. Department of Commerce.
6. If the prime contractor awards subcontracts, require the prime contractor to take the steps in numbers 1 through 5 above.

Required Contract Conditions

These conditions must be included in all procurement contracts entered into by the Borrower for all DWRF and CWRF projects:

1. The prime contractor must pay its subcontractor for satisfactory performance no more than 30 days from the prime contractor's receipt of payment from the owner.
2. The prime contractor must notify the owner in writing prior to the termination of any Disadvantaged Business Enterprise subcontractor for convenience by the prime contractor.
3. If a Disadvantaged Business Enterprise contractor fails to complete work under the subcontract for any reason, the prime contractor must employ the six good faith efforts if soliciting a replacement contractor.
4. The prime contractor must continue to employ the six good faith efforts even if the prime contractor has achieved its fair share objectives.

5. The prime contractor must provide EPA Form 6100-2 DBE Program Subcontractor Participation Form** to all of its Disadvantaged Business Enterprise subcontractors. Disadvantaged Business Enterprise subcontractors may send completed Form 6100-2 directly to the Region 9 DBE Coordinator listed below:

   Joe Ochab, EPA Region 9, 75 Hawthorne St. (P-22), San Francisco, CA 94105

6. The prime contractor must have its Disadvantaged Business Enterprise subcontractors complete EPA Form 6100-3 - DBE Program Subcontractor Performance Form**. The prime contractor must include all completed forms as part of the prime contractor's bid or proposal package to the Borrower.
7. The prime contractor must complete and submit EPA Form 6100-4 DBE Program Subcontractor Utilization Form** as part of the prime contractor's bid or proposal package to the Borrower.
8. A Borrower must ensure that each procurement contract it awards contains the following terms and conditions:

   The contractor shall not discriminate on the basis of race, color, national origin or sex in the performance of this contract. The contractor shall carry out applicable requirements of 40 CFR Part 33 in the award and administration of contracts awarded under EPA financial assistance agreements. Failure by the contractor to carry out these requirements is a material breach of this contract which may result in the termination of this contract or other legally available remedies.

** A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.*

*** DBE forms can be downloaded from http://www.epa.gov/osbp/dbe_fair.htm*

ATTACHMENTS

DBE Forms
http://www.epa.gov/osbp/dbe_fair.htm
6100-2 - DBE Program Subcontractor Participation Form
6100-3 - DBE Program Subcontractor Performance Form
6100-4 - DBE Program Subcontractor Utilization Form

Davis-Bacon Forms
WH-1321 - Davis-Bacon poster
WH-347 - Payroll and certification form
SF1444 - Wage Determination Request form
Employee Interview form

OMB Control No: 2090-0030
Approved: 05/01/2008
Approval Expires: 01/31/2011

Environmental Protection Agency

Disadvantaged Business Enterprise Program
DBE Subcontractor Participation Form

NAME OF SUBCONTRACTOR	PROJECT NAME
ADDRESS	CONTRACT NO.
TELEPHONE NO.	EMAIL ADDRESS
PRIME CONTRACTOR NAME	

Please use the space below to report any concerns regarding the above EPA-funded project (e.g., reason for termination by prime contractor, late payment, etc.).

CONTRACT ITEM NO.	ITEM OF WORK OR DESCRIPTION OF SERVICES RECEIVED FROM THE PRIME CONTRACTOR	AMOUNT SUBCONTRACTOR WAS PAID BY PRIME CONTRACTOR

Subcontractor Signature

Title/Date

OMB Control No: 2090-0030
Approved: 05/01/2008
Approval Expires: 01/31/2011

Environmental
Protection Agency

Disadvantaged Business Enterprise Program
DBE Subcontractor Participation Form

The public reporting and recordkeeping burden for this collection of information is estimated to average fifteen (15) minutes. Burden means the total time, effort, or financial resources expended by persons to generate, maintain, retain, or disclose or provide information to or for a Federal agency. This includes the time needed to review instructions; develop, acquire, install, and utilize technology and systems for the purposes of collecting, validating, and verifying information, processing and maintaining information, and disclosing and providing information; adjust the existing ways to comply with any previously applicable instructions and requirements; train personnel to be able to respond to a collection of information; search data sources; complete and review the collection of information; and transmit or otherwise disclose the information. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including the use of automated collection techniques to the Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed EPA DBE Subcontractor Participation Form to this address.

OMB Control No: 2090-0030
Approved: 05/01/2008
Approval Expires: 01/31/2011

Environmental Protection Agency

Disadvantaged Business Enterprise Program
DBE Subcontractor Performance Form

NAME OF SUBCONTRACTOR1	PROJECT NAME
ADDRESS	BID/PROPOSAL NO.
TELEPHONE NO.	E-MAIL ADDRESS
PRIME CONTRACTOR NAME	

CONTRACT ITEM NO.	ITEM OF WORK OR DESCRIPTION OF SERVICES BID TO PRIME	PRICE OF WORK SUBMITTED TO PRIME CONTRACTOR

Currently certified as an MBE or WBE under EPA's DBE Program? _____ Yes _____ No Signature of Prime Contractor Date Print Name Title _____

_____ Signature of Subcontractor Date

_____ _____ Print Name Title

OMB Control No: 2090-0030
Approved: 05/01/2008
Approval Expires: 01/31/2011

Environmental
Protection Agency

Disadvantaged Business Enterprise Program
DBE Subcontractor Performance Form

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OMB Control No: 2090-0030
Approved: 05/01/2008
Approval Expires: 01/31/2011

Environmental Protection Agency

Disadvantaged Business Enterprise Program
DBE Subcontractor Utilization Form

BID/PROPOSAL NO.	PROJECT NAME
NAME OF PRIME BIDDER/PROPOSER	E-MAIL ADDRESS
ADDRESS	
TELEPHONE NO.	FAX NO.

The following subcontractors[1] will be used on this project:

COMPANY NAME, ADDRESS, PHONE NUMBER, AND E-MAIL ADDRESS	TYPE OF WORK TO BE PERFORMED	ESTIMATED DOLLAR AMOUNT	CURRENTLY CERTIFIED AS AN MBE OR WBE?

I certify under penalty of perjury that the forgoing statements are true and correct. In the event of a replacement of a subcontractor, I will adhere to the replacement requirements set forth in 40 CFR Part 33 Section 33.302(c).

Signature of Prime Contractor _____ Date _____

Print Name _____ Title _____

OMB Control No: 2090-0030
Approved: 05/01/2008
Approval Expires: 01/31/2011

Environmental
Protection Agency

Disadvantaged Business Enterprise Program
DBE Subcontractor Utilization Form

The public reporting and recordkeeping burden for this collection of information is estimated to average fifteen (15) minutes. Burden means the total time, effort, or financial resources expended by persons to generate, maintain, retain, or disclose or provide information to or for a Federal agency. This includes the time needed to review instructions; develop, acquire, install, and utilize technology and systems for the purposes of collecting, validating, and verifying information, processing and maintaining information, and disclosing and providing information; adjust the existing ways to comply with any previously applicable instructions and requirements; train personnel to be able to respond to a collection of information; search data sources; complete and review the collection of information; and transmit or otherwise disclose the information. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including the use of automated collection techniques to the Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed EPA DBE Subcontractor Utilization Form to this address.

EMPLOYEE RIGHTS
UNDER THE DAVIS-BACON ACT
FOR LABORERS AND MECHANICS EMPLOYED ON FEDERAL OR FEDERALLY ASSISTED CONSTRUCTION PROJECTS

THE UNITED STATES DEPARTMENT OF LABOR WAGE AND HOUR DIVISION

PREVAILING WAGES	You must be paid not less than the wage rate listed in the Davis-Bacon Wage Decision posted with this Notice for the work you perform.
OVERTIME	You must be paid not less than one and one-half times your basic rate of pay for all hours worked over 40 in a work week. There are few exceptions.
ENFORCEMENT	Contract payments can be withheld to ensure workers receive wages and overtime pay due, and liquidated damages may apply if overtime pay requirements are not met. Davis-Bacon contract clauses allow contract termination and debarment of contractors from future federal contracts for up to three years. A contractor who falsifies certified payroll records or induces wage kickbacks may be subject to civil or criminal prosecution, fines and/or imprisonment.
APPRENTICES	Apprentice rates apply only to apprentices properly registered under approved Federal or State apprenticeship programs.
PROPER PAY	If you do not receive proper pay, or require further information on the applicable wages, contact the Contracting Officer listed below:

Water Infrastructure Finance Authority of Arizona
1110 West Washington Street, Suite 290
Phoenix, AZ 85007
Tel: (602) 364-1310
Fax: (602) 364-1331

or contact the U.S. Department of Labor's Wage and Hour Division.

For additional information:

1-866-4-USWAGE

(1-866-487-9243) TTY: 1-877-889-5627

WHD U.S. Wage and Hour Division

DERECHOS DEL EMPLEADO
BAJO LA LEY DAVIS-BACON
PARA OBREROS Y MECÁNICOS EMPLEADOS EN PROYECTOS DE CONSTRUCCIÓN FEDERAL O CON ASISTENCIA FEDERAL

LA SECCIÓN DE HORAS Y SUELDOS DEL DEPARTAMENTO DE TRABAJO DE EEUU

SALARIOS PREVALECIENTES No se le puede pagar menos de la tasa de pago indicada en la Decisión de Salarios Davis-Bacon fijada con este Aviso para el trabajo que Ud. desempeña.

SOBRETIEMPO Se le ha de pagar no menos de tiempo y medio de su tasa básica de pago por todas las horas trabajadas en exceso de 40 en una semana laboral. Existen pocas excepciones.

CUMPLIMIENTO Se pueden retener pagos por contratos para asegurarse que los obreros reciban los salarios y el pago de sobretiempo debidos, y se podría aplicar daños y perjuicios si no se cumple con las exigencias del pago de sobretiempo. Las cláusulas contractuales de Davis-Bacon permiten la terminación y exclusión de contratistas para efectuar futuros contratos federales hasta tres años. El contratista que falsifique los registros certificados de las nóminas de pago o induzca devoluciones de salarios puede ser sujeto a procesamiento civil o criminal, multas y/o encarcelamiento.

APRENDICES Las tasas de aprendices sólo se aplican a aprendices correctamente inscritos bajo programas federales o estatales aprobados.

PAGO APROPIADO Si Ud. no recibe el pago apropiado, o precisa de información adicional sobre los salarios aplicables, póngase en contacto con el Contratista Oficial que aparece abajo:

Water Infrastructure Finance Authority of Arizona
1110 West Washington Street, Suite 290
Phoenix, AZ 85007
Tel: (602) 364-1310
Fax: (602) 364-1331

o póngase en contacto con la Sección de Horas y Sueldos del Departamento de Trabajo de EEUU.

Para obtener información adicional:

1-866-4-USWAGE

(1-866-487-9243) TTY: 1-877-889-5627

WHD U.S. Wage and Hour Division

Instructions for Completing Payroll Form, WH-347

OMB Control No. 1235-0008, Expires 01/31/2015.

General: Form WH-347 has been made available for the convenience of contractors and subcontractors required by their Federal or Federally-aided construction-type contracts and subcontracts to submit weekly payrolls. Properly filled out, this form will satisfy the requirements of Regulations, Parts 3 and 5 (29 C.F.R., Subtitle A), as to payrolls submitted in connection with contracts subject to the Davis-Bacon and related Acts.

While completion of Form WH-347 is optional, it is mandatory for covered contractors and subcontractors performing work on Federally financed or assisted construction contracts to respond to the information collection contained in 29 C.F.R. §§ 3.3, 5.5(a). The Copeland Act (40 U.S.C. § 3145) requires contractors and subcontractors performing work on Federally financed or assisted construction contracts to "furnish weekly a statement with respect to the wages paid each employee during the preceding week." U.S. Department of Labor (DOL) Regulations at 29 C.F.R. § 5.5(a)(3)(ii) require contractors to submit weekly a copy of all payrolls to the Federal agency contracting for or financing the construction project, accompanied by a signed "Statement of Compliance" indicating that the payrolls are correct and complete and that each laborer or mechanic has been paid not less than the proper Davis-Bacon prevailing wage rate for the work performed. DOL and federal contracting agencies receiving this information review the information to determine that employees have received legally required wages and fringe benefits.

Under the Davis-Bacon and related Acts, the contractor is required to pay not less than prevailing wage, including fringe benefits, as predetermined by the Department of Labor. The contractor's obligation to pay fringe benefits may be met either by payment of the fringe benefits to bona fide benefit plans, funds or programs or by making payments to the covered workers (laborers and mechanics) as cash in lieu of fringe benefits.

This payroll provides for the contractor to show on the face of the payroll all monies to each worker, whether as basic rates or as cash in lieu of fringe benefits, and provides for the contractor's representation in the statement of compliance on the payroll (as shown on page 2) that he/she is paying for fringe benefits required by the contract and not paid as cash in lieu of fringe benefits. Detailed instructions concerning the preparation of the payroll follow:

Contractor or Subcontractor: Fill in your firm's name and check appropriate box.

Address: Fill in your firm's address.

Payroll No.: Beginning with the number "1", list the payroll number for the submission.

For Week Ending: List the workweek ending date.

Project and Location: Self-explanatory.

Project or Contract No.: Self-explanatory.

Column 1 - Name and Individual Identifying Number of Worker: Enter each worker's full name and an individual identifying number (e.g., last four digits of worker's social security number) on each weekly payroll submitted.

Column 2 - No. of Withholding Exemptions: This column is merely inserted for the employer's convenience and is not a requirement of Regulations, Part 3 and 5.

Column 3 - Work Classifications: List classification descriptive of work actually performed by each laborer or mechanic. Consult classification and minimum wage schedule set forth in contract specifications. If

additional classifications are deemed necessary, see Contracting Officer or Agency representative. An individual may be shown as having worked in more than one classification provided an accurate breakdown or hours worked in each classification is maintained and shown on the submitted payroll by use of separate entries.

Column 4 - Hours worked: List the day and date and straight time and overtime hours worked in the applicable boxes. On all contracts subject to the Contract Work Hours Standard Act, enter hours worked in excess of 40 hours a week as "overtime".

Column 5 - Total: Self-explanatory

Column 6 - Rate of Pay (Including Fringe Benefits): In the "straight time" box for each worker, list the actual hourly rate paid for straight time worked, plus cash paid in lieu of fringe benefits paid. When recording the straight time hourly rate, any cash paid in lieu of fringe benefits may be shown separately from the basic rate. For example, "$12.25/.40" would reflect a $12.25 base hourly rate plus $0.40 for fringe benefits. This is of assistance in correctly computing overtime. See "Fringe Benefits" below. When overtime is worked, show the overtime hourly rate paid plus any cash in lieu of fringe benefits paid in the "overtime" box for each worker; otherwise, you may skip this box. See "Fringe Benefits" below. Payment of not less than time and one-half the basic or regular rate paid is required for overtime under the Contract Work Hours Standard Act of 1962 if the prime contract exceeds $100,000. In addition to paying no less than the predetermined rate for the classification which an individual works, the contractor must pay amounts predetermined as fringe benefits in the wage decision made part of the contract to approved fringe benefit plans, funds or programs or shall pay as cash in lieu of fringe benefits. See "FRINGE BENEFITS" below.

Column 7 - Gross Amount Earned: Enter gross amount earned on this project. If part of a worker's weekly wage was earned on projects other than the project described on this payroll, enter in column 7 first the amount earned on the Federal or Federally assisted project and then the gross amount earned during the week on all projects, thus "$163.00/$420.00" would reflect the earnings of a worker who earned $163.00 on a Federally assisted construction project during a week in which $420.00 was earned on all work.

Column 8 - Deductions: Five columns are provided for showing deductions made. If more than five deduction are involved, use the first four columns and show the balance deductions under "Other" column; show actual total under "Total Deductions" column; and in the attachment to the payroll describe the deduction(s) contained in the "Other" column. All deductions must be in accordance with the provisions of the Copeland Act Regulations, 29 C.F.R., Part 3. If an individual worked on other jobs in addition to this project, show actual deductions from his/her weekly gross wage, and indicate that deductions are based on his gross wages.

Column 9 - Net Wages Paid for Week: Self-explanatory.

Totals - Space has been left at the bottom of the columns so that totals may be shown if the contractor so desires.

Statement Required by Regulations, Parts 3 and 5: While the "statement of compliance" need not be notarized, the statement (on page 2 of the payroll form) is subject to the penalties provided by 18 U.S.C. § 1001, namely, a fine, possible imprisonment of not more than 5 years, or both. Accordingly, the party signing this statement should have knowledge of the facts represented as true.

Items 1and 2: Space has been provided between items (1) and (2) of the statement for describing any deductions made. If all deductions made are adequately described in the "Deductions" column above, state "*See* Deductions column in this payroll." *See* "FRINGE BENEFITS" below for instructions concerning filling out paragraph 4 of the statement.

Item 4 FRINGE BENEFITS - Contractors who pay all required fringe benefits: If paying all fringe benefits to approved plans, funds, or programs in amounts not less than were determined in the applicable

wage decision of the Secretary of Labor, show the basic cash hourly rate and overtime rate paid to each worker on the face of the payroll and check paragraph 4(a) of the statement on page 2 of the WH-347 payroll form to indicate the payment. Note any exceptions in section 4(c).

Contractors who pay no fringe benefits: If not paying all fringe benefits to approved plans, funds, or programs in amounts of at least those that were determined in the applicable wage decision of the Secretary of Labor, pay any remaining fringe benefit amount to each laborer and mechanic and insert in the "straight time" of the "Rate of Pay" column of the payroll an amount not less than the predetermined rate for each classification plus the amount of fringe benefits determined for each classification in the application wage decision. Inasmuch as it is not necessary to pay time and a half on cash paid in lieu of fringe benefits, the overtime rate shall be not less than the sum of the basic predetermined rate, plus the half time premium on basic or regular rate, plus the required cash in lieu of fringe benefits at the straight time rate. In addition, check paragraph 4(b) of the statement on page 2 the payroll form to indicate the payment of fringe benefits in cash directly to the workers. Note any exceptions in section 4(c).

Use of Section 4(c), Exceptions

Any contractor who is making payment to approved plans, funds, or programs in amounts less than the wage determination requires is obliged to pay the deficiency directly to the covered worker as cash in lieu of fringe benefits. Enter any exceptions to section 4(a) or 4(b) in section 4(c). Enter in the Exception column the craft, and enter in the Explanation column the hourly amount paid each worker as cash in lieu of fringe benefits and the hourly amount paid to plans, funds, or programs as fringe benefits. The contractor must pay an amount not less than the predetermined rate plus cash in lieu of fringe benefits as shown in section 4(c) to each such individual for all hours worked (unless otherwise provided by applicable wage determination) on the Federal or Federally assisted project. Enter the rate paid and amount of cash paid in lieu of fringe benefits per hour in column 6 on the payroll. See paragraph on "Contractors who pay no fringe benefits" for computation of overtime rate.

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http://www.dol.gov/whd/forms/wh347instr.htm

U.S. Department of Labor
Wage and Hour Division

PAYROLL

(For Contractor's Optional Use; See Instructions at www.dol.gov/whd/forms/wh347instr.htm)

Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number.

U.S. Wage and Hour Division
Rev. Dec. 2008

OMB No.: 1235-0008
Expires: 01/31/2015

NAME OF CONTRACTOR ☐ OR SUBCONTRACTOR ☐ | ADDRESS

PAYROLL NO. | FOR WEEK ENDING | PROJECT AND LOCATION | PROJECT OR CONTRACT NO.

(1)	(2)	(3)	(4) DAY AND DATE							(5)	(6)	(7)	(8) DEDUCTIONS					(9)
NAME AND INDIVIDUAL IDENTIFYING NUMBER (e.g., LAST FOUR DIGITS OF SOCIAL SECURITY NUMBER) OF WORKER	NO. OF WITHHOLDING EXEMPTIONS	WORK CLASSIFICATION	OT. OR ST.	HOURS WORKED EACH DAY						TOTAL HOURS	RATE OF PAY	GROSS AMOUNT EARNED	FICA	WITH-HOLDING TAX		OTHER	TOTAL DEDUCTIONS	NET WAGES PAID FOR WEEK
			O															
			S															
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While completion of Form WH-347 is optional, it is mandatory for covered contractors and subcontractors performing work on Federally financed or assisted construction contracts to respond to the information collection contained in 29 C.F.R. §§ 3.3, 5.5(a). The Copeland Act (40 U.S.C. § 3145) contractors and subcontractors performing work on Federally financed or assisted construction contracts to "furnish weekly a statement with respect to the wages paid each employee during the preceding week." U.S. Department of Labor (DOL) regulations at

Date _____

I, _____ _____
(Name of Signatory Party) (Title)

do hereby state:

(1) That I pay or supervise the payment of the persons employed by

_____ on the
(Contractor or Subcontractor)

_____; that during the payroll period commencing on the
(Building or Work)

_____ day of _____, _____, and ending the _____ day of _____, _____,

all persons employed on said project have been paid the full weekly wages earned, that no rebates have been or will be made either directly or indirectly to or on behalf of said

_____ from the full
(Contractor or Subcontractor)

weekly wages earned by any person and that no deductions have been made either directly or indirectly from the full wages earned by any person, other than permissible deductions as defined in Regulations, Part 3 (29 C.F.R. Subtitle A), issued by the Secretary of Labor under the Copeland Act, as amended (48 Stat. 948, 63 Start. 108, 72 Stat. 967; 76 Stat. 357; 40 U.S.C. § 3145), and described below:

_____

_____

_____

_____

(2) That any payrolls otherwise under this contract required to be submitted for the above period are correct and complete; that the wage rates for laborers or mechanics contained therein are not less than the applicable wage rates contained in any wage determination incorporated into the contract; that the classifications set forth therein for each laborer or mechanic conform with the work he performed.

(3) That any apprentices employed in the above period are duly registered in a bona fide apprenticeship program registered with a State apprenticeship agency recognized by the Bureau of Apprenticeship and Training, United States Department of Labor, or if no such recognized agency exists in a State, are registered with the Bureau of Apprenticeship and Training, United States Department of Labor.

(4) That:

(a) WHERE FRINGE BENEFITS ARE PAID TO APPROVED PLANS, FUNDS, OR PROGRAMS

☐ – in addition to the basic hourly wage rates paid to each laborer or mechanic listed in the above referenced payroll, payments of fringe benefits as listed in the contract

(b) WHERE FRINGE BENEFITS ARE PAID IN CASH

☐ – Each laborer or mechanic listed in the above referenced payroll has been paid, as indicated on the payroll, an amount not less than the sum of the applicable basic hourly wage rate plus the amount of the required fringe benefits as listed in the contract, except as noted in section 4(c) below.

(c) EXCEPTIONS

EXCEPTION (CRAFT)	EXPLANATION

REMARKS:

NAME AND TITLE	SIGNATURE

THE WILLFUL FALSIFICATION OF ANY OF THE ABOVE STATEMENTS MAY SUBJECT THE CONTRACTOR OR SUBCONTRACTOR TO CIVIL OR CRIMINAL PROSECUTION. SEE SECTION 1001 OF TITLE 18 AND SECTION 231 OF TITLE

SF 1444 Instructions
Request for Additional Classification and Wage Rate Form

Attached is a copy of the federal standard form 1444, Request for Authorization of Additional Classification and Wage Rate. This form must be submitted when a wage classification is not listed on the applicable wage decision. The classification and wage rate submitted on the form should bear a reasonable likeness to similar skill classifications listed in the federal wage determination.

The prime contractor is responsible for the completion and submission of this form. The following are the procedures for the completion and submission of the form:

1.	Check "Construction Contract" in the upper right-hand corner.
Box 2.	Insert the following information: **Water Infrastructure Finance Authority of Arizona (WIFA)** **1110 W. Washington St., Suite 290** **Phoenix, AZ 85007**
Box 3.	Prime contractor's name.
Box 4.	Date the prime contractor submitted the form to WIFA.
Box 5.	Contract number.
Box 6.	Date the bid was opened, if applicable.
Box 7.	Date the contract was awarded.
Box 8.	Actual date the contractor will be starting or started work.
Box 9.	(This box is not applicable.)
Box 10.	List all subcontractors that will utilize the labor classification listed in box 13a. If none, enter "N/A."
Box 11.	Project title and a brief description of the project.
Box 12.	Include both the city and county, as well as Arizona.
Box 13.	Federal "General Decision Number" (e.g. AZ00009) and the date.
Box 13a.	List all classifications not covered by the federal wage determination, which are utilized by either the prime or the subcontractor(s).
Box13b.	The wage rate should bear a reasonable likeness to the category classification wage rates (equipment operators, laborers, truck drivers, etc.) listed in the federal wage determination.
Box 13c.	The fringe rate should bear a reasonable likeness to the category classification fringe rates (equipment operators, laborers, truck drivers, etc.) listed in the federal wage determination.
Box 14.	If there is a subcontractor listed on line 10, its representative signs on this line.
Box 15.	The prime contractor's representative must sign on this line.
Box 16.	If the contractor has a specific employee who will be performing the labor classification(s) listed in box 13a, or if the employees' have legal representation (union, etc.), they should sign this line and include their title. If no specific employee is identified to perform work under the listed classification(s), then write "unknown" in the box. The "Agree" or "Disagree" boxes are checked by anyone signing in boxes 14, 15, and 16.

The contractor will make a copy of the completed signed form and submit the original to WIFA (not required to be in quadruplicate).

WIFA will complete the section below the heavy line TO BE COMPLETED BY CONTRACTING OFFICER and submit it to DOL and EPA. Typically DOL responds in 30

AUTHORIZED FOR LOCAL REPRODUCTION

REQUEST FOR AUTHORIZATION OF ADDITIONAL CLASSIFICATION AND RATE

CHECK APPROPRIATE BOX
☐ SERVICE CONTRACT
☐ CONSTRUCTION CONTRACT

OMB No.: **9000-0089**
Expires: 04/30/2005

INSTRUCTIONS: THE CONTRACTOR SHALL COMPLETE ITEMS 3 THROUGH 16, KEEP A PENDING COPY, AND SUBMIT THE REQUEST, IN QUADRUPLICATE, TO THE CONTRACTING OFFICER.

1. **TO:**
ADMINISTRATOR, Employment Standards Administration
WAGE AND HOUR DIVISION
U.S. DEPARTMENT OF LABOR
WASHINGTON, D.C. 20210

2. **FROM:** *(REPORTING OFFICE)*

3. CONTRACTOR				4. DATE OF REQUEST
5. CONTRACT NUMBER	**6. DATE BID OPENED** *(SEALED BIDDING)*	**7. DATE OF AWARD**	**8. DATE CONTRACT WORK STARTED**	**9. DATE OPTION EXERCISED (If** *APPLICABLE) (SCA ONLY)*

10. SUBCONTRACTOR *(IF ANY)*

11. PROJECT AND DESCRIPTION OF WORK *(ATTACH ADDITIONAL SHEET IF NEEDED)*

12. LOCATION *(CITY, COUNTY AND STATE)*

13. IN ORDER TO COMPLETE THE WORK PROVIDED FOR UNDER THE ABOVE CONTRACT, IT IS NECESSARY TO ESTABLISH THE FOLLOWING RATE(S) FOR THE INDICATED CLASSIFICATION(S) NOT INCLUDED IN THE DEPARTMENT OF LABOR DETERMINATION

NUMBER: _____ DATED: _____

a. LIST IN ORDER: PROPOSED CLASSIFICATION TITLE(S); JOB DESCRIPTION(S); DUTIES; AND RATIONALE FOR PROPOSED CLASSIFICATIONS (SCA ONLY)	b. WAGE RATE(S)	c. FRINGE BENEFITS PAYMENTS

(Use reverse or attach additional sheets, if necessary)

14. SIGNATURE AND TITLE OF SUBCONTRACTOR REPRESENTATIVE *(IF ANY)*

15. SIGNATURE AND TITLE OF PRIME CONTRACTOR REPRESENTATIVE

16. SIGNATURE OF EMPLOYEE OR REPRESENTATIVE	TITLE	CHECK APPROPRIATE BOX-REFERENCING BLOCK 13.
		☐ **AGREE** ☐ **DISAGREE**

TO BE COMPLETED BY CONTRACTING OFFICER ***(CHECK AS APPROPRIATE - SEE FAR 22.1019 (SCA) OR FAR 22.406-3 (DBA))***

☐ THE INTERESTED PARTIES AGREE AND THE CONTRACTING OFFICER RECOMMENDS APPROVAL BY THE WAGE AND HOUR DIVISION. AVAILABLE INFORMATION AND RECOMMENDATIONS ARE ATTACHED.

☐ THE INTERESTED PARTIES CANNOT AGREE ON THE PROPOSED CLASSIFICATION AND WAGE RATE. A DETERMINATION OF THE QUESTION BY THE WAGE AND HOUR DIVISION IS THEREFORE REQUESTED. AVAILABLE INFORMATION AND RECOMMENDATIONS ARE ATTACHED.

(Send copies 1, 2, and 3 to Department of Labor)

SIGNATURE OF CONTRACTING OFFICER OR REPRESENTATIVE	TITLE AND COMMERCIAL TELEPHONE NO.	DATE SUBMITTED

WIFA PROJECT WAGE RATE WORKSHEET

The construction category of Heavy (excluding dam construction) should typically be applied to all projects funded by WIFA. If you believe that a different category of wages, such as Building, should be applied to your project or portions of your project, please contact WIFA in advance.

PROJECT NAME:	WAGE DECISION NUMBER AND DATE:
WIFA PROJECT NUMBER:	PROJECT COUNTY:

WORK CLASSIFICATION	BASIC HOURLY RATE	FRINGE BENEFITS	TOTAL HOURLY WAGE RATE

ADDITIONAL CLASSIFICATIONS NEEDED (DOL FORM SF-1444)

WORK CLASSIFICATION	BASIC HOURLY RATE	FRINGE BENEFITS	TOTAL HOURLY WAGE RATE	DATE OF WIFA SUBMISSION TO DOL	DATE OF DOL APPROVAL

EMPLOYEE INTERVIEW FOR DAVIS-BACON LABOR STANDARDS
INSTRUCTIONS

The Davis-Bacon Act requires interviews to determine if the contractor is complying with the Federal Davis-Bacon prevailing wages. Interviewers must use WIFA's interview form, Department of Labor's Standard Form 1445, or equivalent documentation. WIFA's form may be downloaded from WIFA's website: http://azwifa.gov/?pageid=contract_packet. See Section 5: Compliance Verification of the WIFA Contract Packet for the interview requirements.

Interviews should be conducted in the following manner:

Interviewer: Each borrower is required to conduct interviews. The interviewer must be someone unaffiliated with the contractors and on site regularly (i.e., project manager, or consultant, etc.).

Purpose: The purpose of the interview is to ensure that the work actually being done by construction workers and mechanics is consistent with the corresponding job titles and wages being reported on the certified payrolls. The payroll checker must compare the interviews to the payrolls to identify inconsistencies. Any inconsistencies must be addressed. Keep in mind that both the interview and the information on the interview form are considered confidential. Interviews should be conducted individually and in private. All employees on the work site should be available for an interview if requested by the interviewer; however, the employee's participation is voluntary.

Number of Interviews: A representative sample of interviews is required. The interviewer must interview at least one person from every contractor and subcontractor company on the job site.

Timing: Interviews should be done, at minimum, on two different occasions. One should be within the first two weeks after construction begins and whenever a new subcontractor begins work on the project. The second round should be done closer to substantial completion while workers are still on site. Additional interviews should be done when issues or discrepancies arise and should be targeted at the contractor in question.

Records: Interview forms should be kept by the borrower with the rest of the project records at least three years after the contract is completed. The interview forms have employee information that should be kept confidential from contractors generally, but the project folders must be available for inspection by WIFA, EPA, or Department of Labor upon request.

Item	**INTERVIEW**
2b. - 2c.	This information is required in case it is necessary to follow up with the employee.
3a.	The interviewer should make it clear to the employee that these items relate only to work on this project, not necessarily to other projects.
3b.	Employees should be encouraged (but not required) to produce pay stubs or pay envelopes which document the wages received.
5. - 6.	If the employee does not know where the wage rate decision and Davis-Bacon poster are posted, the interviewer should inform the person of the location(s) and encourage them to look at the documents.
8.	Many employees will not be familiar with the term "fringe benefits." The interviewer should explain to the employee that fringe can be paid as part of their hourly rate, or can be in the form of benefits such as

11. - 13.	Be certain that the employee's responses are specific. The employee may not be familiar with the classifications used on the wage determination and thus may use a term which may not be found on the determination. The answers to questions 12 and 13 should elicit enough information to identify the appropriate wage classification. Confirm the presumed wage classification with the employee.

INTERVIEWER'S COMMENTS	
16.	This represents some of the most important information gathered while conducting on-site interviews. Be specific about the duties the employee was observed performing. It may be easiest to make these observations before the interview. Comments in this section should include whether observed duties and tools used were the same as those described by the employee during the interview.
19. - 20.	This refers to the wage decision and date as posted on the job site. This information should be consistent with the contract documents.

FOR USE BY PAYROLL CHECKER	
21. - 22.	The payroll checker can be the same person as the interviewer. If not, it should be someone familiar with the wage rate decision, labor standards provisions and the construction project. This part of the form is completed *after* receipt of the payroll reports covering the week during which the interview was conducted. It is important that the payroll reports are received in a timely manner so that the payroll checker can compare and verify the interview information and investigate discrepancies. Once the corresponding payroll reports are received, the information on the interview form must be compared to the payroll reports. Specifically, the payroll checker must check that: • the payroll report is consistent with the dates and hours the employee worked (Items 9a.-9c.). • the payroll report indicates that the employee's job classification is the same as that indicated by the employee in Items 11 - 13. • the payroll report indicates that the employee received the wages as s/he stated in Item 3a. • the payroll report indicates that the employee received the fringe benefits in the amount and as stated in Item 8. • the wages/fringes paid agree with the wage rate decision in the contract and any additional classification requests approved by DOL (SF1444). Any discrepancies noted between the interview form and payroll reports shall be reported in Item 22. <u>If discrepancies are noted, follow-up actions to resolve the discrepancies must be taken</u>. For example, if the payroll indicates that the employee worked a different number of hours than the employee indicated, the payroll checker must: a) contact the employee and ask for clarification; and b) request the contractor's actual time records. This should be done without revealing the identity of the employee, e.g. by asking for all employee records for one work week.

EMPLOYEE INTERVIEW FOR DAVIS-BACON LABOR STANDARDS

1a. Project Name		2a. Employee Name
1b. Contract Number	Wage Decision and Date	2b. Employee Phone Number
1c. Name of Prime Contractor		2c. Employee Home Address and Zip Code
1d. Name of Employer and Supervisor		

3a. Hourly rate of pay on this project: 3b. Do you have your most recent paystub? Y ☐ N ☐	4. Do you know that you are working on a federally-funded project and that you are to be paid wages set by DOL (Davis-Bacon wages)? Y ☐ N ☐	5. Do you know where the Davis-Bacon Wage Rate Decision for this project is posted? Y ☐ N ☐	6. Do you know where the "Employee Rights under the Davis-Bacon Act" poster is posted? Y ☐ N ☐
7a. Do you ever work over 8 hours per day? Y ☐ N ☐	7b. Do you ever work over 40 hours per week? Y ☐ N ☐	7c. Are you paid at least time and a half for overtime hours? Y ☐ N ☐ N/A ☐	8. Do you receive Fringe Benefits? Vacation Y ☐ N ☐ Medical Y ☐ N ☐ Pension Y ☐ N ☐ Cash/pay Y ☐ N ☐ Other:
9a. Date you began work on this project:	9b. Date of last work day on this project before interview:	9c. How many hours did you work on your last work day before this interview on this job?	
10. What deductions other than taxes and social security are made from your pay?		11. Work Classification (list all on this project):	
12. Your duties on this project:		13. Tools and equipment you use on this project:	

THE ABOVE IS CORRECT TO THE BEST OF MY KNOWLEDGE

14. Employee Signature	Date	
15. Interviewer Signature	Interviewer Name	Date

INTERVIEWER'S COMMENTS

16. Work employee was doing/tools employee was using when interviewed:	17. Is employee properly classified and paid? Y ☐ N ☐	18. Are wage rate and poster displayed? Y ☐ N ☐
	19. Wage Rate Decision Number:	20. Wage Rate Decision Date:

FOR USE BY PAYROLL CHECKER

21. Is above information in agreement with payroll data? Y ☐ N ☐	22. If no, provide explanation and resolution:

23. Payroll Checker Signature	Payroll Checker Name	Date

General Decision Number: AZ140024 02/14/2014 AZ24

Superseded General Decision Number: AZ20130024

State: Arizona

Construction Type: Building
BUILDING CONSTRUCTION, Includes Building Construction on Treatment Plants and on Industrial Sites (Chemical/Processing/Manufacturing Plants, Power Plants, Refineries, Nuclear Plants, Etc.)

County: Cochise County in Arizona.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Modification Number	Publication Date
0	01/03/2014
1	01/17/2014
2	02/14/2014

* BRAZ0003-009 07/01/2013

	Rates	Fringes
BRICKLAYER	$ 22.83	6.37

* CARP1327-001 01/01/2014

	Rates	Fringes
CARPENTER (Drywall Hanging Only)	$ 19.75	6.46

ELEC0570-007 12/01/2013

	Rates	Fringes
ELECTRICIAN (Including Alarm Installation and Low Voltage Wiring)	$ 24.20	18%+5.00

ZONE DEFINITIONS-

Zone A: the area within a twenty-nine (29) mile radius from a basing point at the Tucson Town Hall.
Zone B: 29 to 46 mile radius from the town hall in Tucson- an additional $ 1.25 per hour
Zone C: 47 mile radius from the town hall in Tucson to the outer limits of the geographic jurisdiction- an additional

POWER EQUIPMENT OPERATOR:
(CRANE)
(2) under 15 tons.....$ 24.26 9.34
(3) 15 tons to 100 tons,
Tower Crane.....$ 25.34 9.34
(4) 100 tons and over.....$ 26.37 9.34

IRON0075-002 01/01/2014

	Rates	Fringes
IRONWORKER, REINFORCING AND STRUCTURAL	$ 26.52	21.02

Zone 1: 0 to 50 miles from City Hall in Phoenix or Tucson
Zone 2: 050 to 100 miles - Add $4.00
Zone 3: 100 to 150 miles - Add $5.00
Zone 4: 150 miles & over - Add $6.50

LABO0383-005 11/01/2013

	Rates	Fringes
LABORER (MASON TENDER-BRICK)	$ 18.63	4.35

PAIN0086-006 04/01/2013

	Rates	Fringes
DRYWALL FINISHER/TAPER		
ZONE A	$ 19.00	5.03
ZONE B	$ 22.50	5.03

ZONE PAY:

ZONE A: Free Zone: A distance of 0 to 100 miles from the old Phoenix courthouse.

ZONE B: A distance of 101 miles and over from the old Phoenix courthouse: $3.50 per hour over ZONE A

ROOF0135-001 06/01/2011

	Rates	Fringes
ROOFER (Includes Installation of Metal Roofs)	$ 18.60	4.18

SUAZ2012-012 05/30/2012

	Rates	Fringes

GLAZIER	$ 28.00	0.00
LABORER: Common or General	$ 12.50	2.76
LABORER: Landscape & Irrigation	$ 9.31	0.00
LABORER: Mason Tender - Cement/Concrete	$ 16.05	1.49
OPERATOR: Backhoe	$ 14.00	1.80
PAINTER: Brush, Roller and Spray	$ 16.13	0.00
PIPEFITTER	$ 22.21	6.12
PLUMBER	$ 22.75	0.00
SHEET METAL WORKER	$ 18.68	4.91
SPRINKLER FITTER (Fire Sprinklers)	$ 16.48	2.94
TILE SETTER	$ 15.93	0.45

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is union or non-union.

Union Identifiers

An identifier enclosed in dotted lines beginning with

an internal number used in processing the wage determination. The date, 07/01/2011, following these characters is the effective date of the most current negotiated rate/collective bargaining agreement which would be July 1, 2011 in the above example.

Union prevailing wage rates will be updated to reflect any changes in the collective bargaining agreements governing the rates.

0000/9999: weighted union wage rates will be published annually each January.

Non-Union Identifiers

Classifications listed under an "SU" identifier were derived from survey data by computing average rates and are not union rates; however, the data used in computing these rates may include both union and non-union data. Example: SULA2004-007 5/13/2010. SU indicates the rates are not union majority rates, LA indicates the State of Louisiana; 2004 is the year of the survey; and 007 is an internal number used in producing the wage determination. A 1993 or later date, 5/13/2010, indicates the classifications and rates under that identifier were issued as a General Wage Determination on that date.

Survey wage rates will remain in effect and will not change until a new survey is conducted.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal

Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION

CONTRACT BOND
STATUTORY PERFORMANCE BOND PURSUANT TO
TITLE 34, CHAPTER 2, ARTICLE 2,
OF THE ARIZONA REVISED STATUTES
(Penalty of this bond must be 100% of the Contract amount)

KNOW ALL MEN BY PRESENTS:

That, _____(hereinafter called the Principal) as Principal, and _____a corporation organized and existing under the law of the State of _____with its principal office in the City of _____(hereinafter called the Surety), as Surety, are held and firmly bound unto the City of Bisbee, State of Arizona in the amount of _____ Dollars ($_____, for the payment whereof, the said Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

Whereas, the principal has entered into a certain written contract with the City of Bisbee, dated the ____day of _____, 20___, for _____which contract is hereby referred to and made a part hereof as fully and to the same extent as if copied at length herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the said Principal shall faithfully perform and fulfill all the undertakings, covenants, terms, conditions and agreements of said contract during the original term of said contract and any extension thereof, with or without notice to the Surety, and during the life any guaranty required under the covenants, terms, conditions, and agreements of any and all duly authorized modifications of said contract that may hereafter be made, notice of which modifications to the Surety being hereby waived; then the above obligation shall be void, otherwise to remain in full force and effect.

PROVIDED, HOWEVER, that this bond is executed pursuant to the provisions of Title 34, Chapter 2, Article 2, of the Arizona Revised Statutes, and all liabilities on this bond shall be determined in accordance with the provisions of said Title, Chapter and Article, to the extent as if it were copied at length herein.

The prevailing party in a suit on this bond shall be entitled to such reasonable attorney's fees as may be fixed by a judge of the Court.

Witness our hands this ____day of _____, 20__.

_____
PRINCIPAL SEAL

_____
AGENT OF RECORD BY: _____

_____
SURETY SEAL

_____
AGENT ADDRESS
BY:_____

LABOR AND MATERIALS BOND
STATUTORY PAYMENT BOND PURSUANT TO
TITLE 34 CHAPTER 2, ARTICLE 2
OF THE ARIZONA REVISED STATUTES
(Penalty of this bond must be 100% of the Contract amount)

KNOW ALL MEN BY THESE PRESENTS:

That, _____(hereinafter called the Principal), as Principal, and _____, a corporation organized and existing under the laws of the State of _____, with its principal office in the City of _____, (hereinafter called the Surety), as Surety, are held and firmly bound unto the City of Bisbee, State of Arizona (hereinafter called the Obligee), in the amount of _____(Dollars ($_____), for the payment whereof, the said Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written contract with the Obligee dated the ____day of _____, 20___, for _____which contract is hereby referred to and made a part hereof as fully and to the same extent as if copied at length herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the said Principal shall promptly pay all monies due to all persons supplying labor or materials to him or his subcontractors in the prosecution of the work provided for in said contract, then this obligation shall be void, otherwise to remain in full force and effect.

PROVIDED, HOWEVER, that this bond is executed pursuant to the provisions of Title 34, Chapter 2, Article 2, of the Arizona Revised Statutes, and all liabilities on this bond shall be determined in accordance with the provisions of said Title, Chapter and Article, to the extent as if it were copied at length herein.

The prevailing party in a suit on this bond shall be entitled to such reasonable attorney's fees as may be fixed by a judge of the court.

Witness our hands this ____day of _____, 20___.

_____
PRINCIPAL SEAL

_____
AGENT OF RECORD
BY:_____

SURETY SEAL

_____
AGENT ADDRESS
BY:_____

CITY OF BISBEE
CHANGE ORDER REQUEST

Date:_____ Request No.:_____

Project: CW 013-2013A SAN JOSE WWTP PHOTOVOLTAIC (PV) SOLAR POWER GENERATION SYSTEM

Contractor:_____

Description of Proposed Change Order:_____

_____

Reason for Change:_____

_____

_____

_____

Estimated Cost: $_____ Change in Contract Time:_____
(See Attached Sheet for Detailed Cost) (Calendar Days)

NOTE: Unless waived in writing by the Public Works Director, contractor shall submit cost or pricing data in support of and prior to the issue of a contract modification by the City.

Submitted by: _____ Title: _____

Recommended by: _____ Title: _____

Approved by: _____ Title: _____

CONTRACTOR CERTIFICATION OF COMPLETION AND EXPRESSED WARRANTIES

Acceptance Date:_____

The undersigned Contractor Agent hereby certifies that Project No. CW 013-2013A San Jose WWTP Photovoltaic (PV) Solar Power Generation System is complete to acceptable standards as defined in the plans and specifications for the said Project Contract Agreement. All materials used and workmanship performed are expressly warranted to be free of defects for a period of two years from the date of final acceptance by the City Public Works Director.

Signed and dated at _____, this ____day of _____, 20___.

_____
Contractor

BY:_____
Signature

_____
Title

STATE OF_____)
) ss
COUNTY OF_____)

On this, the ____ day of _____, 20___, before me the undersigned officer, personally appeared _____, known to me to be the person who subscribed the foregoing instrument, and acknowledged that he executed the same for and on behalf of said person/corporation for the purposes therein expressed.

_____
Notary Public

My Commission Expires _____.

UNCONDITIONAL WAIVER AND RELEASE ON FINAL PAYMENT
(Pursuant to A.R.S. § 33-1008)

Project: CW 013-2013A SAN JOSE WWTP PHOTOVOLTAIC (PV) SOLAR POWER GENERATION SYSTEM

The undersigned has been paid in full for all labor, services, equipment or material furnished to the jobsite or to the City of Bisbee, on the job of _____ located at _____ and does hereby waive and release any right to mechanic's lien, any state or federal statutory bond right, any private bond right, any claim for payment and any rights under any similar ordinance, rule or statute related to claim or payment rights for persons in the undersigned's position, except for disputed claims for extra work in the amount of $_____.

The undersigned warrants that he either has already paid or will use the monies he receives from this final payment to promptly pay in full all his laborers, subcontractors, material and suppliers for all work, materials, equipment or services provided for or to the above referenced project.

Dated: _____

_____
(Company Name)

_____
(Signature)

_____
(Title)

NOTICE:
This document waives rights unconditionally and states that you have been paid for giving up those rights. This document is enforceable against you if you sign it, even if you have not yet been paid. If you have not been paid, use a conditional release form.

STATE OF_____)
) ss
COUNTY OF_____)

On this, the ____ day of _____, 20___, before me the undersigned officer, personally appeared _____, known to me to be the person who subscribed the foregoing instrument, and acknowledged that he executed the same for and on behalf of said person/corporation for the purpose therein expressed.

_____
Notary Public

My Commission expires _____.

CONDITIONAL WAIVER AND RELEASE ON FINAL PAYMENT
(Pursuant to A.R.S. § 33-1008)

Project: CW 013-2013A SAN JOSE WWTP PHOTOVOLTAIC (PV) SOLAR POWER GENERATION SYSTEM

On receipt by the undersigned of a check from the City of Bisbee in the sum of $_____ payable to _____ and when the check has been properly endorsed and has been paid by the bank on which it is drawn, this document becomes effective to release any mechanic's lien, any state or federal statutory bond right, any private bond right, any claim for payment and any rights under any similar ordinance, rule or statute related to claim or payment rights for persons in the undersigned's position, the undersigned has on the job of _____ located at _____. This release covers the final payment to the undersigned for all labor, services, equipment or materials furnished to the jobsite or to the City of Bisbee, except for disputed claims in the amount of $ _____. Before any recipient of this document relies on it, the person should verify evidence of payment to the undersigned.
The undersigned warrants that he either has already paid or will use the monies he receives from this final payment to promptly pay in full all his laborers, subcontractors, material and suppliers for all work, materials, equipment or services provided for or to the above referenced project up to the date of this waiver.

Dated: _____

_____
(Company Name)

_____
(Signature)

_____
(Title)

STATE OF_____)
) ss
COUNTY OF_____)

On this, the ____ day of _____, 20___, before me the undersigned officer, personally appeared _____, known to me to be the person who subscribed the foregoing instrument, and acknowledged that he executed the same for and on behalf of said person/corporation for the purpose therein expressed.

_____
Notary Public

My Commission expires _____.

LOCKTON

June 12, 2014

City of Bisbee, State of Arizona
118 Arizona Street
Bisbee, AZ 85603

Re: Performance Contracting, Inc.
Bond #106112667
Bond Amount: $1,039,349.00
CW013-2013A San Jose WWTP Photovoltaic (PV) Solar Power Generation System

To Whom It May Concern:

This letter will serve as your authority to date the Bonds and the Powers of Attorney on the above captioned project.

Very truly yours,

Travelers Casualty and Surety Company of America

By:_____
Debra J. Scarborough
Attorney-in-Fact

CONTRACT BOND
STATUTORY PERFORMANCE BOND PURSUANT TO TITLE 34, CHAPTER 2, ARTICLE 2, OF THE ARIZONA REVISED STATUTES
(Penalty of this bond must be 100% of the Contract amount)

KNOW ALL MEN BY PRESENTS:

That, Performance Contracting, Inc. (hereinafter called the Principal) as Principal, and Travelers Casualty and Surety Company of America a corporation organized and existing under the law of the State of Connecticut with its principal office in the City of Hartford (hereinafter called the Surety), as Surety, are held and firmly bound unto the City of Bisbee, State of Arizona in the amount of One Million Thirty-Nine Thousand Three Hundred Forty-Nine and No/100 Dollars ($ 1,039,349.00), for the payment whereof, the said Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

Whereas, the principal has entered into a certain written contract with the City of Bisbee, dated the 18th day of June, 2014, for CW013-2013A San Jose WWTP Photovoltaic (PV) Solar Power Generation System which contract is hereby referred to and made a part hereof as fully and to the same extent as if copied at length herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the said Principal shall faithfully perform and fulfill all the undertakings, covenants, terms, conditions and agreements of said contract during the original term of said contract and any extension thereof, with or without notice to the Surety, and during the life any guaranty required under the covenants, terms, conditions, and agreements of any and all duly authorized modifications of said contract that may hereafter be made, notice of which modifications to the Surety being hereby waived; then the above obligation shall be void, otherwise to remain in full force and effect.

PROVIDED, HOWEVER, that this bond is executed pursuant to the provisions of Title 34, Chapter 2, Article 2, of the Arizona Revised Statutes, and all liabilities on this bond shall be determined in accordance with the provisions of said Title, Chapter and Article, to the extent as if it were copied at length herein.

The prevailing party in a suit on this bond shall be entitled to such reasonable attorney's fees as may be fixed by a judge of the Court.

Witness our hands this 18th day of June, 2014.

Performance Contracting, Inc.
4401 Freidrich Lane, Suite 300, Austin, TX 78744
PRINCIPAL SEAL
Charles F. Williams
Sr. V.P. / Secretary

Kansas City Series of Lockton Companies, LLC
AGENT OF RECORD

BY: Debra J. Scarborough

Travelers Casualty and Surety Company of America
One Tower Square, Hartford, CT 06183 (860) 277-0111
SURETY SEAL

444 W. 47th Street, Suite 900, Kansas City, MO 64112-1906
AGENT ADDRESS

BY: Debra J. Scarborough, Attorney-in-Fact

Bond No. 106112667

LABOR AND MATERIALS BOND
STATUTORY PAYMENT BOND PURSUANT TO
TITLE 34 CHAPTER 2, ARTICLE 2
OF THE ARIZONA REVISED STATUTES
(Penalty of this bond must be 100% of the Contract amount)

KNOW ALL MEN BY THESE PRESENTS:

That, Performance Contracting, Inc. (hereinafter called the Principal), as Principal, and Travelers Casualty and Surety Company of America, a corporation organized and existing under the laws of the State of Connecticut, with its principal office in the City of Hartford, (hereinafter called the Surety), as Surety, are held and firmly bound unto the City of Bisbee, State of Arizona (hereinafter called the Obligee), in the amount of One Million Thirty-Nine Thousand Three Hundred Forty-Nine and No/100 (Dollars ($ 1,039,349.00), for the payment whereof, the said Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written contract with the Obligee dated the ____day of _____, 20___, for CW013-2013A San Jose WWTP Photovoltaic (PV) Solar Power Generation System which contract is hereby referred to and made a part hereof as fully and to the same extent as if copied at length herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the said Principal shall promptly pay all monies due to all persons supplying labor or materials to him or his subcontractors in the prosecution of the work provided for in said contract, then this obligation shall be void, otherwise to remain in full force and effect.

PROVIDED, HOWEVER, that this bond is executed pursuant to the provisions of Title 34, Chapter 2, Article 2, of the Arizona Revised Statutes, and all liabilities on this bond shall be determined in accordance with the provisions of said Title, Chapter and Article, to the extent as if it were copied at length herein.

The prevailing party in a suit on this bond shall be entitled to such reasonable attorney's fees as may be fixed by a judge of the court.

Witness our hands this 18th day of June, 2014.

Performance Contracting, Inc.
4401 Freidrich Lane, Suite 306, Austin, TX 78744

PRINCIPAL

Charles E. Williams
Sr. V.P. / Secretary

Kansas City Series of Lockton Companies, LLC
AGENT OF RECORD
BY: _____
Debra J. Scarborough
Travelers Casualty and Surety Company of America
One Tower Square, Hartford, CT 06183 (860) 277-0111
SURETY SEAL

444 W. 47th Street, Suite 900, Kansas City, MO 64112-1906
AGENT ADDRESS
BY: _____

WARNING: THIS POWER OF ATTORNEY IS INVALID WITHOUT THE RED BORDER

TRAVELERS

POWER OF ATTORNEY

Farmington Casualty Company
Fidelity and Guaranty Insurance Company
Fidelity and Guaranty Insurance Underwriters, Inc.
St. Paul Fire and Marine Insurance Company
St. Paul Guardian Insurance Company
St. Paul Mercury Insurance Company
Travelers Casualty and Surety Company
Travelers Casualty and Surety Company of America
United States Fidelity and Guaranty Company

Attorney-In Fact No. 227707 **Certificate No.** 005839095

KNOW ALL MEN BY THESE PRESENTS: That Farmington Casualty Company, St. Paul Fire and Marine Insurance Company, St. Paul Guardian Insurance Company, St. Paul Mercury Insurance Company, Travelers Casualty and Surety Company, Travelers Casualty and Surety Company of America, and United States Fidelity and Guaranty Company are corporations duly organized under the laws of the State of Connecticut, that Fidelity and Guaranty Insurance Company is a corporation duly organized under the laws of the State of Iowa, and that Fidelity and Guaranty Insurance Underwriters, Inc., is a corporation duly organized under the laws of the State of Wisconsin (herein collectively called the "Companies"), and that the Companies do hereby make, constitute and appoint

Patrick T. Pribyl, Debra J. Scarborough, Christy M. McCart, Mary T. Flanigan, Ronald J. Lockton, Claudia Mandato, Jeffrey C. Carey, Kathy L. Fagan, Charles R. Teter III, Laura M. Buhrmester, Charissa D. Lecuyer, Evan D. Sizemore, David M. Lockton, Rebecca S. Gross, Larissa Smith, and Wendy A. Casey

of the City of Kansas City, State of Missouri, their true and lawful Attorney(s)-in-Fact, each in their separate capacity if more than one is named above, to sign, execute, seal and acknowledge any and all bonds, recognizances, conditional undertakings and other writings obligatory in the nature thereof on behalf of the Companies in their business of guaranteeing the fidelity of persons, guaranteeing the performance of contracts and executing or guaranteeing bonds and undertakings required or permitted in any actions or proceedings allowed by law.

IN WITNESS WHEREOF, the Companies have caused this instrument to be signed and their corporate seals to be hereto affixed, this 20th day of March, 2014.

Farmington Casualty Company
Fidelity and Guaranty Insurance Company
Fidelity and Guaranty Insurance Underwriters, Inc.
St. Paul Fire and Marine Insurance Company
St. Paul Guardian Insurance Company
St. Paul Mercury Insurance Company
Travelers Casualty and Surety Company
Travelers Casualty and Surety Company of America
United States Fidelity and Guaranty Company

State of Connecticut
City of Hartford ss.

By: _____
Robert L. Raney, Senior Vice President

On this the 20th day of March, 2014, before me personally appeared Robert L. Raney, who acknowledged himself to be the Senior Vice President of Farmington Casualty Company, Fidelity and Guaranty Insurance Company, Fidelity and Guaranty Insurance Underwriters, Inc., St. Paul Fire and Marine Insurance Company, St. Paul Guardian Insurance Company, St. Paul Mercury Insurance Company, Travelers Casualty and Surety Company, Travelers Casualty and Surety Company of America, and United States Fidelity and Guaranty Company, and that he, as such, being authorized so to do, executed the foregoing instrument for the purposes therein contained by signing on behalf of the corporations by himself as a duly authorized officer.

In Witness Whereof, I hereunto set my hand and official seal.
My Commission expires the 30th day of June, 2016.

MARIE C. TETREAULT NOTARY PUBLIC

Marie C. Tetreault
Marie C. Tetreault, Notary Public

ARIZONA STATUTORY BID BOND FOR CONSTRUCTION

PURSUANT TO TITLES 28, 34, AND 41, ARIZONA REVISED STATUTES

(Penalty of this bond must not be less than 10% of the bid amount)

KNOW ALL MEN BY THESE PRESENTS THAT: Performance Contracting, Inc.

(hereinafter "Principal") as Principal, and Travelers Casualty and Surety Company of America

(hereinafter "Surety"), a corporation organized and existing under the laws of the State of Connecticut, with its principal offices in the City of Hartford, holding a certificate of authority to transact surety business in Arizona issued by the Director of the Department of Insurance pursuant to Title 20, Chapter 2, Article 1, as Surety, are held and firmly bound unto the **City of Bisbee** (hereinafter "Obligee") in the sum of Ten Percent (10%) of the amount of the bid of the Principal, submitted by Principal to the Obligee for the work described below, for the payment of which sum, the Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents. WHEREAS, the Principal has submitted a bid for:

CW 013-2013A San Jose WWTP Photovoltaic (PV) Solar Power Generation System

NOW, THEREFORE, if the Obligee shall accept the proposal of the Principal and the Principal shall enter into a contract with the Obligee in accordance with the terms of the proposal and give the bonds and certificates of insurance as specified in the standard specifications of Contract documents with good and sufficient surety for the faithful performance of the contract and for the prompt payment of labor and materials furnished in the prosecution of the contract, or in the event of the failure of the Principal to enter into the contract and give the bonds and certificates of insurance, if the Principal pays to the Obligee the difference not to exceed the penalty of the bond between the amount specified in the proposal and such larger amount for which Obligee may in good faith contract with another party to perform the work covered by the proposal then this obligation is void. Otherwise, it remains in full force and effect provided, however, that this bond is executed pursuant to the provisions of Section 34-201, Arizona Revised Statutes, and all liabilities on this bond shall be determined in accordance with the provisions of that section to the extent as if it were copied at length herein.

Witness our hands this 20th day of May, 2014.

Performance Contracting, Inc.
4401 Freidrich Lane, Suite 306, Austin, TX 78744
PRINCIPAL SEAL

By _____
Charles F. Williams
Title: Sr. V.P. / Secretary

Travelers Casualty and Surety Company of America
One Tower Square, Hartford, CT 06183 (860) 277-0111
SURETY SEAL

By _____
(Attorney - in - Fact)
Debra J. Scarborough
Kansas City Series of Lockton Companies, LLC
Agency of Record

444 W. 47th Street, Suite 900, Kansas City, MO 64112-1906 (816) 960-9000
Agency Address

_____
Arizona Resident Agent Countersignature
Gayle Kunkel

WARNING: THIS POWER OF ATTORNEY IS INVALID WITHOUT THE RED BORDER

TRAVELERS

POWER OF ATTORNEY

Farmington Casualty Company
Fidelity and Guaranty Insurance Company
Fidelity and Guaranty Insurance Underwriters, Inc.
St. Paul Fire and Marine Insurance Company
St. Paul Guardian Insurance Company

St. Paul Mercury Insurance Company
Travelers Casualty and Surety Company
Travelers Casualty and Surety Company of America
United States Fidelity and Guaranty Company

Attorney-In Fact No. 227707

Certificate No. 005838590

KNOW ALL MEN BY THESE PRESENTS: That Farmington Casualty Company, St. Paul Fire and Marine Insurance Company, St. Paul Guardian Insurance Company, St. Paul Mercury Insurance Company, Travelers Casualty and Surety Company, Travelers Casualty and Surety Company of America, and United States Fidelity and Guaranty Company are corporations duly organized under the laws of the State of Connecticut, that Fidelity and Guaranty Insurance Company is a corporation duly organized under the laws of the State of Iowa, and that Fidelity and Guaranty Insurance Underwriters, Inc., is a corporation duly organized under the laws of the State of Wisconsin (herein collectively called the "Companies"), and that the Companies do hereby make, constitute and appoint

Patrick T. Pribyl, Debra J. Scarborough, Christy M. McCart, Mary T. Flanigan, Ronald J. Lockton, Claudia Mandato, Jeffrey C. Carey, Kathy L. Fagan, Charles R. Teter III, Laura M. Buhrmester, Charissa D. Lecuyer, Evan D. Sizemore, David M. Lockton, Rebecca S. Gross, Larissa Smith, and Wendy A. Casey

of the City of Kansas City, State of Missouri, their true and lawful Attorney(s)-in-Fact, each in their separate capacity if more than one is named above, to sign, execute, seal and acknowledge any and all bonds, recognizances, conditional undertakings and other writings obligatory in the nature thereof on behalf of the Companies in their business of guaranteeing the fidelity of persons, guaranteeing the performance of contracts and executing or guaranteeing bonds and undertakings required or permitted in any actions or proceedings allowed by law.

IN WITNESS WHEREOF, the Companies have caused this instrument to be signed and their corporate seals to be hereto affixed, this 20th day of March, 2014.

Farmington Casualty Company
Fidelity and Guaranty Insurance Company
Fidelity and Guaranty Insurance Underwriters, Inc.
St. Paul Fire and Marine Insurance Company
St. Paul Guardian Insurance Company

St. Paul Mercury Insurance Company
Travelers Casualty and Surety Company
Travelers Casualty and Surety Company of America
United States Fidelity and Guaranty Company

State of Connecticut
City of Hartford ss.

By: _____
Robert L. Raney, Senior Vice President

On this the 20th day of March, 2014, before me personally appeared Robert L. Raney, who acknowledged himself to be the Senior Vice President of Farmington Casualty Company, Fidelity and Guaranty Insurance Company, Fidelity and Guaranty Insurance Underwriters, Inc., St. Paul Fire and Marine Insurance Company, St. Paul Guardian Insurance Company, St. Paul Mercury Insurance Company, Travelers Casualty and Surety Company, Travelers Casualty and Surety Company of America, and United States Fidelity and Guaranty Company, and that he, as such, being authorized so to do, executed the foregoing instrument for the purposes therein contained by signing on behalf of the corporations by himself as a duly authorized officer.

In Witness Whereof, I hereunto set my hand and official seal.
My Commission expires the 30th day of June, 2016.

MARIE C. TETREAULT NOTARY PUBLIC CONNECTICUT

_____
Marie C. Tetreault, Notary Public

WARNING: THIS POWER OF ATTORNEY IS INVALID WITHOUT THE RED BORDER

This Power of Attorney is granted under and by the authority of the following resolutions adopted by the Boards of Directors of Farmington Casualty Company, Fidelity and Guaranty Insurance Company, Fidelity and Guaranty Insurance Underwriters, Inc., St. Paul Fire and Marine Insurance Company, St. Paul Guardian Insurance Company, St. Paul Mercury Insurance Company, Travelers Casualty and Surety Company, Travelers Casualty and Surety Company of America, and United States Fidelity and Guaranty Company, which resolutions are now in full force and effect, reading as follows:

RESOLVED, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President, any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary may appoint Attorneys-in-Fact and Agents to act for and on behalf of the Company and may give such appointee such authority as his or her certificate of authority may prescribe to sign with the Company's name and seal with the Company's seal bonds, recognizances, contracts of indemnity, and other writings obligatory in the nature of a bond, recognizance, or conditional undertaking, and any of said officers or the Board of Directors at any time may remove any such appointee and revoke the power given him or her; and it is

FURTHER RESOLVED, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President may delegate all or any part of the foregoing authority to one or more officers or employees of this Company, provided that each such delegation is in writing and a copy thereof is filed in the office of the Secretary; and it is

FURTHER RESOLVED, that any bond, recognizance, contract of indemnity, or writing obligatory in the nature of a bond, recognizance, or conditional undertaking shall be valid and binding upon the Company when (a) signed by the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary and duly attested and sealed with the Company's seal by a Secretary or Assistant Secretary; or (b) duly executed (under seal, if required) by one or more Attorneys-in-Fact and Agents pursuant to the power prescribed in his or her certificate or their certificates of authority or by one or more Company officers pursuant to a written delegation of authority; and it is

FURTHER RESOLVED, that the signature of each of the following officers: President, any Executive Vice President, any Senior Vice President, any Vice President, any Assistant Vice President, any Secretary, any Assistant Secretary, and the seal of the Company may be affixed by facsimile to any Power of Attorney or to any certificate relating thereto appointing Resident Vice Presidents, Resident Assistant Secretaries or Attorneys-in-Fact for purposes only of executing and attesting bonds and undertakings and other writings obligatory in the nature thereof, and any such Power of Attorney or certificate bearing such facsimile signature or facsimile seal shall be valid and binding upon the Company and any such power so executed and certified by such facsimile signature and facsimile seal shall be valid and binding on the Company in the future with respect to any bond or understanding to which it is attached.

I, Kevin E. Hughes, the undersigned, Assistant Secretary, of Farmington Casualty Company, Fidelity and Guaranty Insurance Company, Fidelity and Guaranty Insurance Underwriters, Inc., St. Paul Fire and Marine Insurance Company, St. Paul Guardian Insurance Company, St. Paul Mercury Insurance Company, Travelers Casualty and Surety Company, Travelers Casualty and Surety Company of America, and United States Fidelity and Guaranty Company do hereby certify that the above and foregoing is a true and correct copy of the Power of Attorney executed by said Companies, which is in full force and effect and has not been revoked.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed the seals of said Companies this MAY 20 2014 day of _____, 20 __.

Kevin E. Hughes, Assistant Secretary

To verify the authenticity of this Power of Attorney, call 1-800-421-3880 or contact us at www.travelersbond.com. Please refer to the Attorney-In-Fact number, the above-named individuals and the details of the bond to which the power is attached.

DISCLAIMER

The data supplied below is based on your specific request(s) and is correct to the best of our knowledge as of the date and time it was extracted from our data files. The information is provided without personal research or analysis. The data is subject to change on a daily basis. You may obtain additional public records related to any licensee, including dismissed complaints and nondisciplinary actions and orders, by contacting the ROC directly. If this information is required for legal purposes, you may request an affidavit or certified copies for a fee as specified in **A.R.S. 32-1104A3**. Please read our Standard Disclaimer at **www.azroc.gov/Legal/Disclaim.html**

Please note: The company or individuals listed on this license may hold other Arizona contracting licenses. To view information, status and complaint history for the past two years on other licenses held, go to the License Inquiry page and do a "Company Name and Personnel" search by entering the name of the company or individuals listed on the license.

Details for License Number 265503 (Friday, May 16, 2014 2:02:40 PM)

Contractor		License	
Name/ Address/ Phone	**Status/ Action**	**Class | Type | Entity**	**Issued/Renewal**
Briston Construction LLC 309 E 10th Dr Mesa, AZ 85210-8706 **Phone:** (480) 776-5810	CURRENT - ACTIVE	KA | DUAL | LLC	**First Issued:** 07/16/2010 **Renewed Thru:** 07/31/2014

License Class & Description **KA DUAL ENGINEERING**

Qualifying Party and Personnel

The Qualifying Party listed below is associated with this license. All other persons named, if any, are associated with the company. They are not all necessarily associated with this license.

Name	Daniel Lee Briscoe	**Name**	Brandon Pearson Carr
Position	QP/MEMBER	**Qual Date** 08/01/2012	**Position** MEMBER

Complaint Information

*Complaints against this contractor are listed below. Complaints that were cancelled, resolved or settled without a corrective work order or dismissed are not included. Contact the **Registrar of Contractors at 602-542-1525 or toll-free statewide at 1-877-MY AZROC (1-877-692-9762)** to identify the ROC office location you need to visit to view complete complaint documentation.*

Open:	0	This is the number of complaints against this contractor that are currently open except those in which an agency inspection has not occurred or a violation was not found. Upon adjudication some complaints are found to be without merit and are dismissed.
Closed Cases		
Disciplined:	0	This is the number of times this license has been disciplined.
Resolved/Settled/ Withdrawn:	0	This is the number of complaints closed against this contractor that were resolved or settled by the contractor or withdrawn by the complainant after issuance of a corrective work order or formal citation.
Denied Access:	0	This is the number of complaints against this contractor that were closed without corrective work being performed because the contractor was denied access by the complainant.

RECEIPT OF ADDENDA

(Must be submitted with the Bid)

CW 013-2013A SAN JOSE WWTP PHOTOVOLTAIC (PV) SOLAR POWER GENERATION SYSTEM

In compliance with the Advertisement for Bids, by the Public Works Director, the undersigned Bidder:

Having examined the contract documents, site of work, and being familiar with the conditions to be met, hereby submits the following Proposal for furnishing the material, equipment, labor and everything necessary for the completion of the work listed, and agrees to execute the contract documents and furnish the required bonds and certificates of insurance for the completion of said work at the locations and for the prices set forth on the inside pages of this form.

Understands that construction of this project shall be in accordance with all applicable Uniform Standard Specifications and Standard Details except as otherwise required by the Project Plans and Special Provisions.

Understands that his proposal shall be submitted with a proposal guarantee of cash, certified check, cashier's check or surety bond for an amount not less than ten percent (10%) of the amount bid.

Agrees that upon receipt of Notice of Award from the City of Bisbee, he shall execute the contract documents.

Agrees that all work on Project CW 013-2013A SAN JOSE WWTP PHOTOVOLTAIC (PV) SOLAR POWER GENERATION SYSTEM shall be completed by the following dates; substantially completed by 120 calendar days from NTP, with final completion by 14 calendar days following Substantial Completion. The time allowed for completion of the work includes lead time for obtaining the necessary material and/or equipment.

The Bidder hereby acknowledges receipt of and agrees his proposal is based on the following addenda:

Addendum No. 1, Dated May 12, 2014

Addendum No. _____, Dated _____

Addendum No. _____, Dated _____

Addendum No. _____, Dated _____

_____
(Signature)

Senior Sales Engineer, Performance Contracting, Inc.
(Title)

NON-COLLUSION AFFIDAVIT

(Must be submitted with the Bid)

CW 013-2013A SAN JOSE WWTP PHOTOVOLTAIC (PV)
SOLAR POWER GENERATION SYSTEM

I certify that this bid is genuine and is not in any way collusive or sham; that the bid is not made with the intent to restrict or prohibit competition, that this firm has not revealed the contents of the bid to, or in any way colluded with, any other firm which may compete for the contract; and that no other firm which may compete for the contract has revealed the contents of a bid to, or in any way colluded with, this firm.

Name of Firm Submitting Bid Performance Contracting, Inc

Address 4401 Freidrich Lane #306

Austin, TX 78744

Telephone Number: 512-443-0535

Facsimile Number: 512-443-3404

Authorized Signature

This affidavit is required pursuant to Arizona Revised Statutes 34-253 and 41-2549. Failure to submit this affidavit signed at the time of bid opening is grounds for disqualification of the bid.

State of TEXAS)
)ss
County of TRAVIS)

Before me a Notary Public in and for said County and State personally appeared the above named who signed the foregoing affidavit and attested that the same was his free act and deed.

Dated this 16 day of May 2014.

MISTY WHITE
Notary Public, State of Texas
My Commission Expires
April 22, 2018

Misty White
Notary Public

My Commission expires 4/22/18.

City of Bisbee
CW 013-2013A
SAN JOSE WWTP PHOTOVOLTAIC (PV) SOLAR POWER GENERATION SYSTEM
Proposal Form

1. The Undersigned Bidder declares that he has read the Specifications and other Contract Documents, has examined and understands the Plans, has examined the site of the work and has determined for himself the conditions affecting the work, and he proposes and agrees if this Proposal is accepted, to provide at his own expense, all labor, insurance, superintendence, machinery, plant, equipment, tools, apparatus, appliances, and means of construction, and all materials and supplies and to complete, ready for its intended purpose, the entire work and all parts thereof described as included under the Contract herein bid upon, in the manner and items prescribed, including all work incidental thereto, according to the Plans and Specifications and such instructions as the City of Bisbee's authorized agent may give.

2. The Undersigned Bidder, in compliance with your Notice Inviting Bids dated TBD, hereby proposes to do the work called for in said Specifications and other Contract Documents and shown on said Plans for the said work at the following rates and prices:

BID SCHEDULE

ITEM		AMOUNT DOLLARS & CENTS
Base Bid (Required)	**Please specify included in Base Bid** (circle one for each equipment type): **Panels:** (Canadian Solar) Central Solar Solar World **Inverters:** Power-One SMA Sunny Tripower	$ 1,039,349

Bid Alternates (Optional):
Bidder has the opportunity to provide bid alternates. If elected, please fill out the line items below, specify ***manufacturer/model (if applicable), and attach cut sheets*** for proposed equipment. Engineer shall review proposed alternates to ensure equipment is "or equal" to the Base Bid specifications. The Engineer and City will determine which alternates will be accepted to include in overall bid price.

ITEM		ADD OR DEDUCT AMOUNT
Panel Bid Alternate (Optional)	**Manufacturer/model of proposed alternate** (please specify): Conergy 250P	$ (13,333.33)
Inverter Bid Alternate (Optional)	**Manufacturer/model of proposed alternate** (please specify):	$
Footing Bid Alternate (Optional)	Pile Driven Footing in lieu of Concrete Base	

Combined Bid Impact (Optional):
If Bidder is selected to perform both CW 013-2013A and CW 013-2013B, Bidder shall provide below the impact (add or deduct) of this Bid amount.

ITEM	ADD OR DEDUCT IMPACT AMOUNT
Combined Bid Impact (Optional) **Impact in Total CW 013-2013A Project Price**	$

3a. PROPOSAL QUANTITIES. It is expressly understood and agreed by the parties hereto that the proposal quantities of the various classes of work to be done and material to be furnished under this Contract, which have been estimated as stated in the Proposal, are only approximate and are to be used SOLELY for the purpose of comparing, on a consistent basis, the proposals offered for the work under this Contract; and the Contractor further agrees that the City of Bisbee will not be held responsible if any of the quantities shall be found incorrect; and the Contractor will not make any claim for damages or for loss of profits because of a difference between the quantities of the various classes of work as estimated and the work actually done.

3b. PROPOSAL QUANTITIES. If any error, omission, or misstatement is found to occur in the estimated quantities, the same shall not invalidate this Contract or release the Contractor from the execution and completion of the whole or any part of the work in accordance with the Project Specifications and Contract Documents and the Plans herein mentioned, or for the prices herein agreed upon and fixed therefore, or excuse him from any of the obligations or liabilities hereunder, or entitle him to any damages or compensation except as may be provided for in this Contract.

4. The undersigned agrees, upon written notice of the acceptance of this bid, within ninety (90) days after the opening of the bids, that he will execute the Contract in accordance with the bid as accepted and give contract (Performance and Payment) Bonds on the forms included herein within fifteen (15) days after the prescribed forms are presented for signature.

5. The undersigned further agrees that if awarded the Contract, he will commence work within fifteen (15) calendar days after receipt of Notice to Proceed and that the work will be shall be completed according to the contract times; within 120 days of the NTP. Liquidated Damages apply if any of these completion dates are not met. The Contractor shall pay liquidated damages for each missed completion date in accordance with Paragraph 5 of the Special Provisions, in the amount of Five Hundred Seventy Dollars ($5,70.00) for each calendar day the work remains uncompleted after the designated completion dates.

6. As an evidence of good faith in submitting this proposal, the undersigned encloses a certified check, cashier's check or bid bond in the amount not less than ten percent (10%) of the total amount of the bid, which, in case he refuses or fails to accept an award and to enter into a contract and file the required bonds within the prescribed time, shall be forfeited to the City of Bisbee, as liquidated damages.

7. The undersigned hereby declares that the only parties interested in this proposal are named herein, that this proposal is made without collusion with any other person, firm or corporation, that no employee of the City of Bisbee, officer or agent, is directly or indirectly financially

8. The undersigned understands that this agreement may be cancelled by the City of Bisbee for conflict of interest pursuant to Arizona Revised Statutes Section 38-511.

9. The undersigned has checked carefully all the above figures and understands that the City of Bisbee, will not be responsible for any errors or omissions on the part of the undersigned in making up this bid.

10. The undersigned understands that the City of Bisbee, reserves the right to reject any or all bids or to waive any informalities in the bid.

THIS PROPOSAL IS SUBMITTED BY Performance Contracting, Inc, a corporation organized under the laws of the State of Kansas, a partnership consisting of NA, or an individual trading as NA of the City of lenexa and is the holder of Arizona State Contractor's License:

Classification B-1 No. 83336

****using subcontractor's A class for permitting***

Respectfully Submitted

FIRM: Performance Contracting, Inc

BY: _____ (signature)

ADDRESS: 4401 Freidrich Lane, Ste 306

Craig Alan Floyd
Name (print or type)

Austin, TX 78744

Operations Manager
Title (print or type)

DATE: 5/16/14

ATTEST:

Misty White, Notary
Officer and Title

Witness: If Bidder is an Individual

MISTY WHITE
Notary Public, State of Texas

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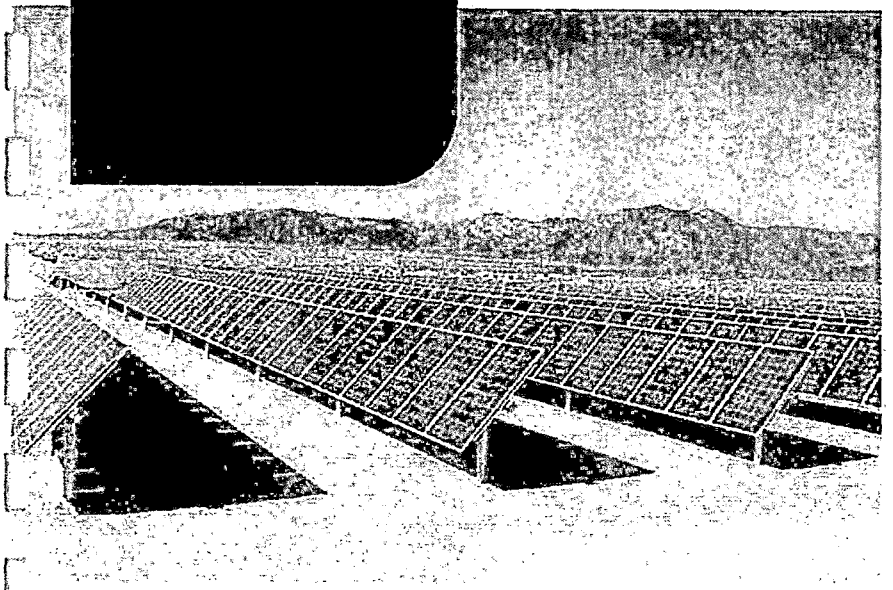
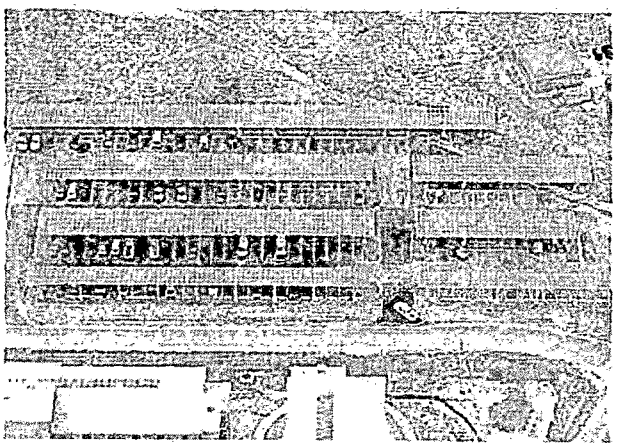
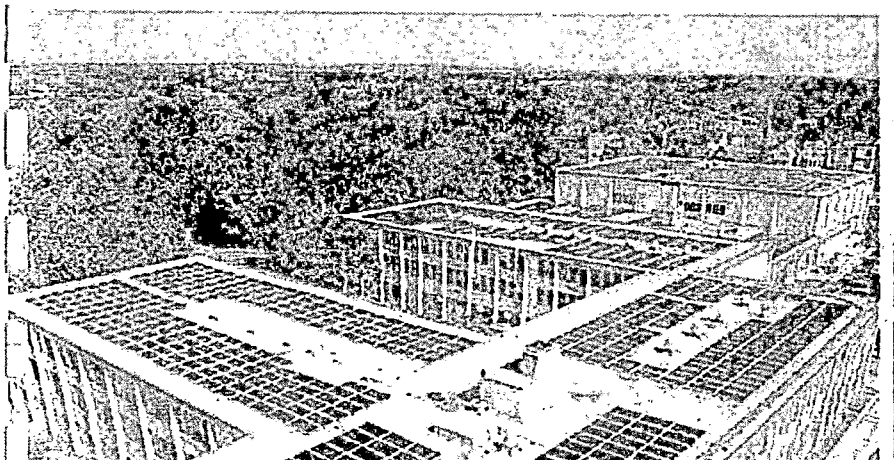
AN AMERICAN ORIGINAL
CITY OF BISBEE ARIZONA

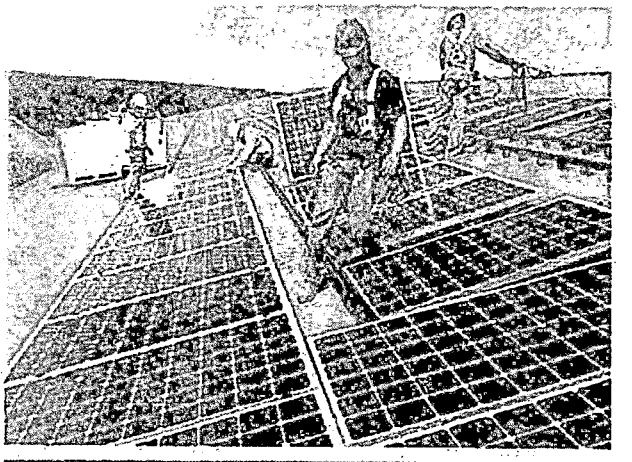
City of Bisbee
Response to Request for Proposals –
San Jose WWTP Photovoltaic Solar Power Generation System #CW013-2013A

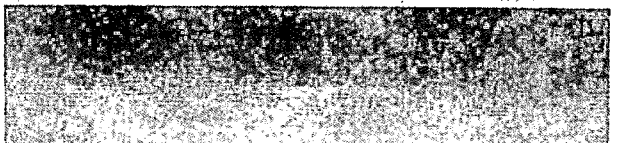
May 20, 2014











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PCI
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I. Letter of Transmittal

May 18, 2014

City of Bisbee
118 Arizona Street
Bisbee, AZ 85603

Attn.: City Clerk

Re.: Request for Proposal San Jose WWTP Photovoltaic Power Generation System

Performance Contracting Inc. is pleased to submit our Statement of Qualifications and bid schedule for the installation of the Solar PV as per plans and specifications issued by the City of Bisbee.

Performance Contracting Inc. is one of the nation's largest and most successful commercial specialties construction contractors with expertise in many facets of commercial construction including solar photovoltaic engineering, procurement, and construction management. The firm was founded in 1984 and has grown to over $1 billion in annual revenue today by providing exceptional service, quality, and safety to our customers. Performance Contracting Inc. services a wide variety of customers including Federal, State and Local governmental agencies, national and local General Contractors, and single and multi-site commercial enterprises nationwide.

For this project, the person authorized to contractually obligate the organization is Jay Bridgewater – Regional Manager-PCI Texas; the person authorized to negotiate the contract on behalf of the organization is Maggie Maher, Corporate Contract Analyst; and the person to be contacted for Statement of Qualifications or Bid Proposal clarifications is Craig Floyd, Operations Manager – National Solar Energy Services.

VALUE ENGINEERING OPPORTUNITIES

We have determined several opportunities for value engineering for this project that lie outside the bid schedules scope. For instance, it may be possible to avoid the cost of rebuilding the 800A switchgear by landing the solar power on the main buss bar using a line-side tap. PCI has earned a reputation for value engineering projects and passing that value onto the customer. We realize that making solar power more affordable serves our customers, the industry and our reputation.

If you have any questions, please feel free to contact Craig Floyd at 512.443.0535 or craig.floyd@pcg.com.

With Best Regards,

Craig Floyd
Operations Manager

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II. Executive Summary

The City of Bisbee is requesting Proposals from firms interested in providing a minimum of two grid-tied solar photovoltaic power generating systems totaling 400kW DC, a portion of which will be placed atop a cleaning bay and the rest on a new ground mounted, fix tilt racking system. This will be a complex project which will require consideration for APS Energy's interconnection requirements, installation area, available solar resources, applicable City of Bisbee zoning ordinances and codes, campus and facility hours of operation, construction restrictions, on line reliability of the proposed system, and required standards and specifications. This project will require a qualified team of solar and commercial specialty construction professionals working in close collaboration with designated Bisbee staff and other contractors participating in this project.

Given the City's desired completion schedule requirement, PCI Solar Energy has prepared a comprehensive and detailed schedule designed to meet all construction expectations. PCI Solar is prepared to initiate procurement immediately upon contract award, and to assign multiple installation crews to achieve this aggressive completion schedule.

This Proposal includes "turn-key" procurement and construction of the solar photovoltaic systems with Briston Construction LLC as subcontractor to PCI Solar Energy. Briston Construction LLC (SBE, SDVOSB) will also be the permit holder for this project (Class A License). With the team composed of Briston Construction and PCI Solar Energy, the City of Bisbee is able to take advantage of the project management expertise, safety experience and purchasing power that PCI brings to the project and the construction licensing and electrical experience held by Briston.

The ultimate objective of this collaboration is to provide the maximum design and cost efficiency with the highest sensitivity to San Jose WWTP operations, thereby helping the City of Bisbee meet its energy goals now and into the future. Performance Contracting Inc. is committed to providing the highest level of service and value in the implementation of this renewable energy solution.

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III - Background, Experience and Qualifications of Design-Build Team

Performance Contracting Inc. - Engineering, Procurement and Construction

Performance Contracting Inc. (PCI Solar Energy) is an established, experienced, financially sound and professional commercial construction management company and commercial specialties contractor. PCI Solar's Management Team has established a successful history of completing extremely complex projects for customers nationwide, on time and on budget. PCI's nationwide customers include Apple, Intel, and Applied Materials, among others and it is the nation's largest cleanroom design-build contractor. PCI has one of the lowest EMR's in the construction industry and has award winning safety programs. PCI Solar Energy is currently the Prime Contractor for the Alamo Heights Independent School District PV Array Project and is providing overall engineering, materials procurement, construction management, scheduling, and required bonding. PCI Solar Energy's division management and engineering team brings years of industry experience and relationships nationwide, and has extensive experience working with Federal, State, and local government customers on solar projects across the country. This team has delivered solar projects for Passaic Valley Independent School District (New Jersey), Irving Independent Schools District (Irving, Texas), and Alamo Heights Independent School District (San Antonio, Texas), the United States Navy (Gulfport, MS.), and Texas Parks and Wildlife Department (Statewide), among many others (See Past Project References below)). Performance Contracting Inc. has offices nationwide, and employs 5000+ team members across the country including 39 LEED AP Accredited Professionals.

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Performance Contracting Inc. – Past Project References

Team Members Involved in Project	Project	Scope Description	Services Provided	Sector	Inter-connecting Utility	Client Name	Contact Person and Phone #
Michael Christie **David McFalls** **Zac Paxton** **Craig Floyd**	U.S. Navy Base- Gulfport, MS Ingleside	582kW Roof mount PV 1.64MW roof	Engineering, Procurement and Construction	Federal Government	Private	ACC/Shaw	Lee Urbanovsky 512.719-5251 ACC/Shaw GC (Lee is now with SpawGlass)
Michael Christie **David McFalls** **Zac Paxton** **Craig Floyd**	Alamo Heights ISD	1MW + roof mount PV and ground mount PV campus wide	Full EPC	Public School	CPS Energy	Alamo Heights ISD	Mike Hagar Asst. Superintendent of Business/Finance 210.822.3374
Michael Christie **David McFalls** **Zac Paxton** **Craig Floyd**	Texas Parks and Wildlife statewide	Carport and roof mount projects statewide (450kW)	Full EPC	State Government	Oncor CPS Austin Energy	State of Texas	Andie Chamberlain 512-389-8652
Roger Jennings	White Sands Missle Range	4MW ground mount plus 400kW carport mount pv	Engineering and Construction Management	Federal Government		Siemens Industry, Inc.	Pam Aytar Alternative Energy Group Building Technologies cell: 913-645-
Roger Jennings	Austin Community College	312kW roof mount pv	Full EPC	Higher Education	Austin Energy	ACC	Andrew Kim Sustainability Officer (512) 223-1129
Michael Christie **David McFalls** **Zac Paxton** **Craig Floyd**	Holt Caterpillar Statewide Texas facilities	1MW + distributed pv statewide	Full EPC	Private Enterprise	Oncor CPS Austin Energy Reliant	HoltCat	Tony Shedrock V.P. Operations (800) 275-4658
Roger Jennings	Camp Mabry	140kW carport mount pv	Full EPC	State Government	Austin Energy	Texas National Guard	Ted Wilson 2200 W 35th St, Austin, TX 78703 (512) 782-5101

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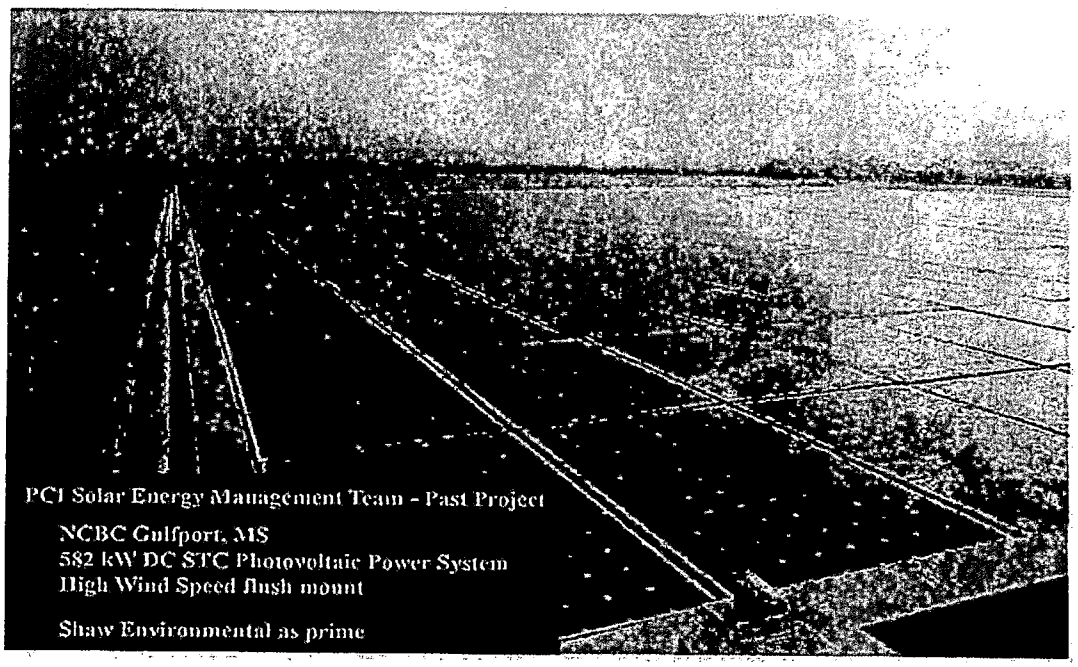

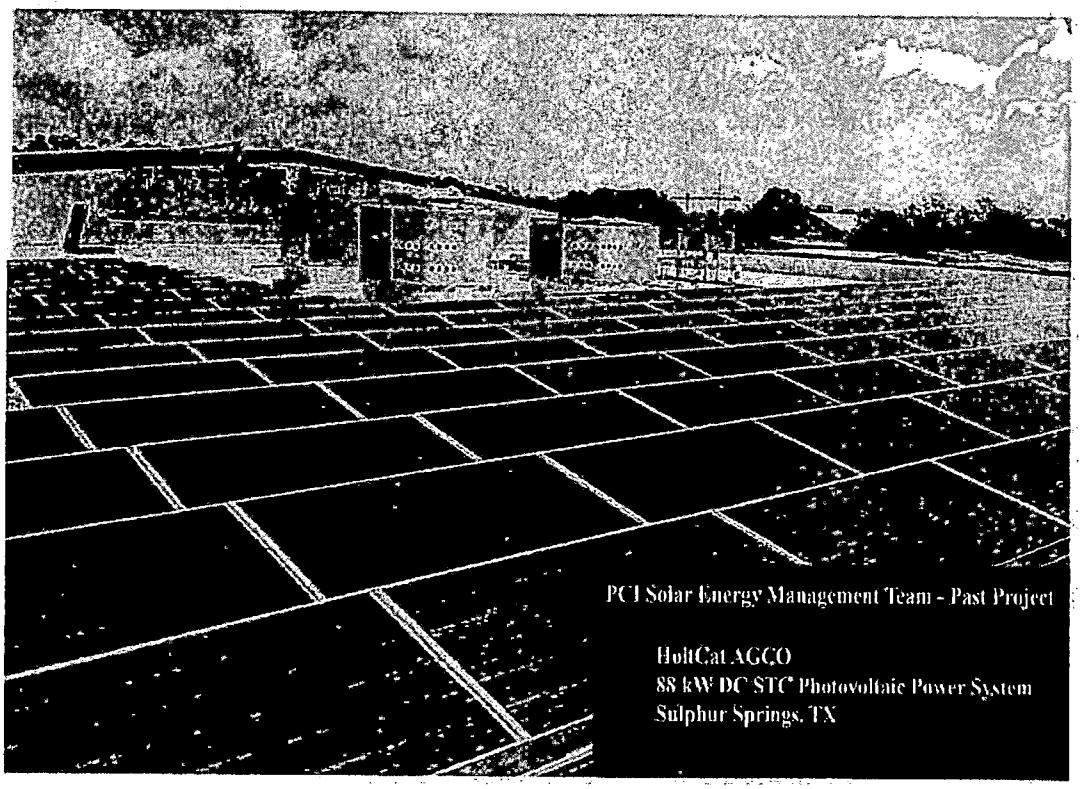

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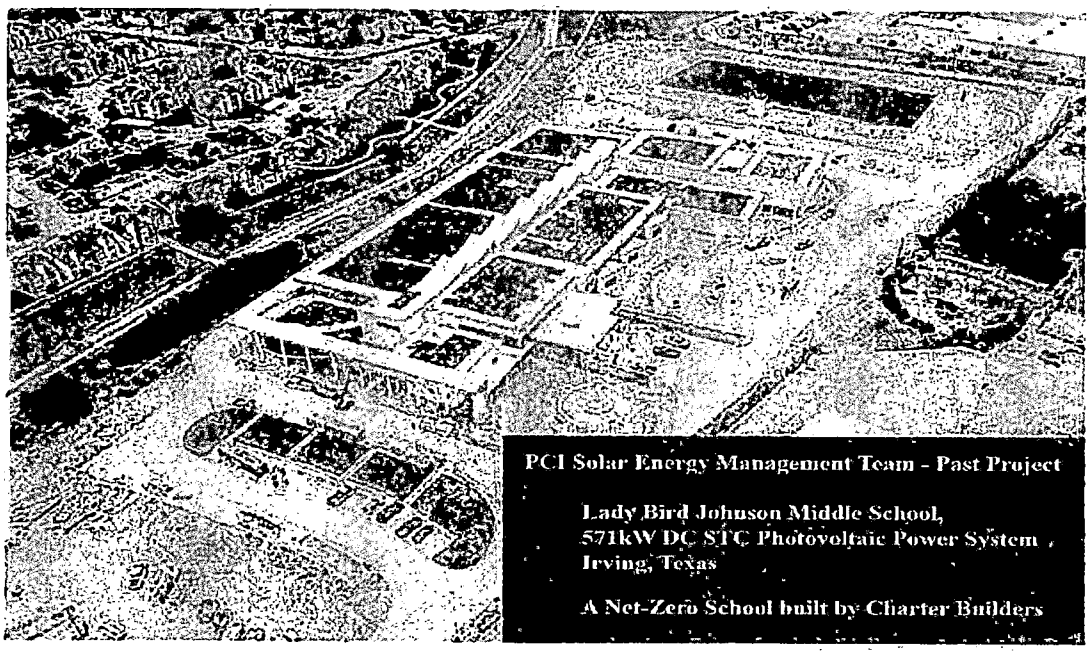
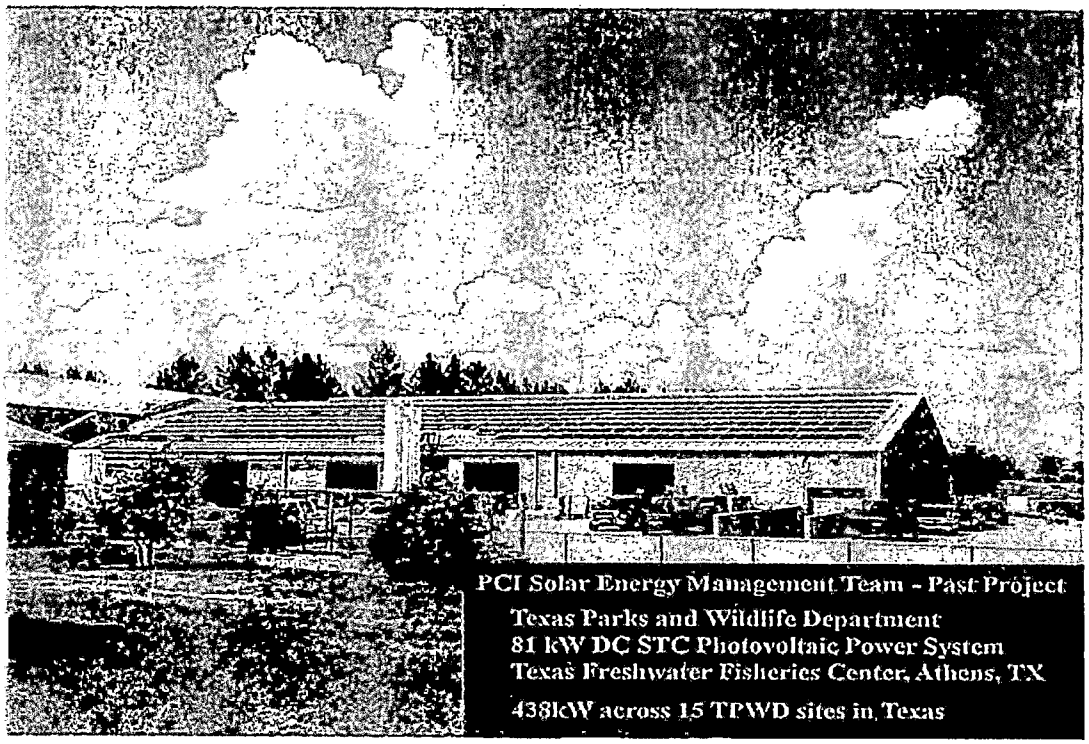


PCI Solar Energy Management Team - Past Project

Lady Bird Johnson Middle School,
571kW DC STC Photovoltaic Power System ,
Irving, Texas

A Net-Zero School built by Charter Builders



PCI Solar Energy Management Team - Past Project

Texas Parks and Wildlife Department
81 kW DC STC Photovoltaic Power System
Texas Freshwater Fisheries Center, Athens, TX

438kW across 15 TPWD sites in Texas

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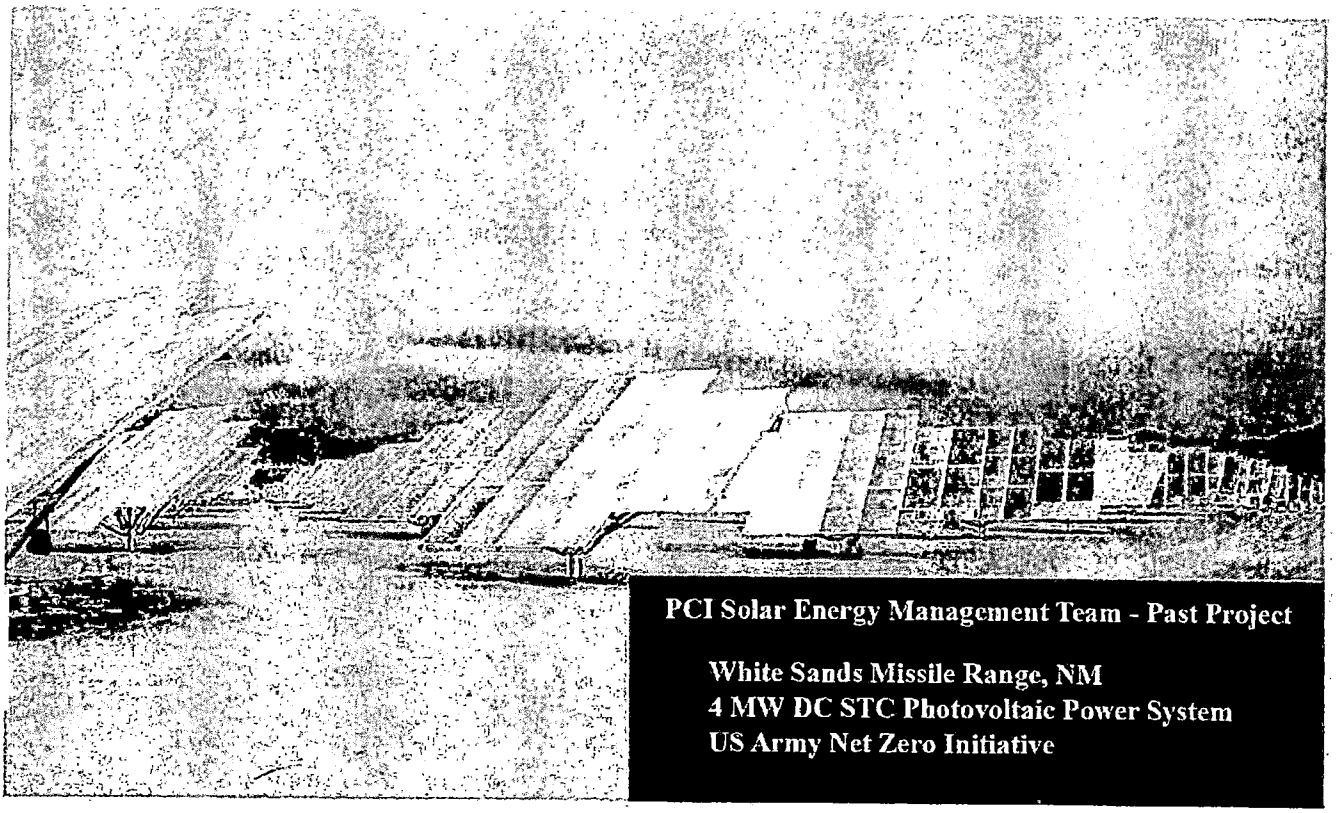

PCI Solar Energy Management Team - Past Project

White Sands Missile Range, NM
4 MW DC STC Photovoltaic Power System
US Army Net Zero Initiative

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Financial Information - Performance Contracting, Inc.

Revenues (Last Three Years)

Year	Dollar Volume	Year	Dollar Volume	Year	Dollar Volume
2013	$943,628,000	2012	$870,779,000	2011	$719,584,000

Net Worth (Last Three Years)

Year	Net Worth	Year	Net Worth	Year	Net Worth
2013	$139,840,000	2012	$117,236,000	2011	$106,921,000

Projected Revenues (This Year and Next Year)

2014	$1,020,000,000	2015	$1,050,000,000	2016	$1,080,000

Current Backlog:		$439,448,002	
As of last year-end statement	$439,448,002	Date:	9/30/2013
As of previous year-end statement	$427,721,919	Date:	9/30/2012

Largest individual contract completed:

$53,000,000 – Kaiser Sunset Hospital

Largest completed contract in 2012:

$36,000,000 - Global Foundries Fab 8 Mod 1

NOTES: Financial information is reflective of Performance Contracting Group, Inc.

Audited Financial Statements available upon request

Bond Capacity per Project = $75,000,000 Bond Capacity Aggregate = $750,000,000 Bank Line of Credit = $40,000,000

Performance Contracting Inc. is fully committed and able to assign a complete dedicated project management and engineering team and all necessary human and financial capital resources to the successful completion of the San Jose WWTP Grid-Tied PV Array Project development. This will include mobilization of internal team members, and subcontractors, as well as full procurement of all necessary materials. This team is led by Craig Floyd, Operations Manager. David McFalls, P.E., Senior Solar Design Engineer will have primary design and engineering responsibilities. Zac Paxton, NABCEP Certified Master Electrician will serve as Project Manager and Roger Jennings, NABCEP Certified Design Engineer will serve as Assistant Project Manager (See Exhibit D – Contractor's Qualification Statement).

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PV Project Approach/Management Plan

The results of the initial site survey including physical characteristics of the interconnection requirements were conveyed to estimating team for compliance. At contract award, value engineering efforts will immediately begin developing construction documents for all required APS and the City of Bisbee submittals. During construction the engineering team shall make periodic quality control checks and will lead the final system commissioning process.

PCI Solar Energy's procurement management begins in advance when firm commitments from suppliers are collected prior to the final job schedule being issued. PCI has earned an excellent reputation among our suppliers through our use of accurate and detailed bills of material, and strict adherence to project schedules. Rush orders are minimized due to the policy of scheduling the material to be delivered in time for any corrections to be made before work begins. PCI staff members are always present for the delivery to ensure quality and completeness of the order and to secure the site once the material has been delivered. All suppliers for PCI Solar Energy must pass a rigorous qualification process that ensures they are financially healthy, reliable, have the capacity to supply the project, and are price competitive.

The San Jose solar project is going to require a very skilled and experienced approach to construction project management in order to avoid disruption of normal activities and coordinate with the site prep contractor. PCI Solar Energy staff members have a long record of successful project management on sensitive sites. PCI Solar Energy utilizes a project management approach that emphasizes communication between all stakeholders. Weekly stakeholder meetings ensure that all parties are heard and kept up to date while weekly internal meetings and daily site meetings keep the project on track. Quality control is achieved through a four part approach. First, the project team selects quality system components. This means that in addition to the major equipment, every piece down to the nuts and washers are carefully selected in order to ensure that the system outlives its expected useful lifespan. Next is the careful preparation of the construction drawings. The vast experience of PCI engineers ensures that this task is handled properly and efficiently. Third, the placement of a NABCEP certified Master Electrician as the QA/QC manager in the field. Lastly the PCI Chief Solar Engineer visits the site for scheduled quality checks. This all important extra step ensures that all parts of the system have been checked and tested by highly trained and qualified personnel. It is the policy of PCI Solar Energy that the project manager always be present on site while work is being performed. This ensures that site management issues like parking, noise mitigation, dust control, and traffic control are never neglected.

At PCI Solar Energy, Safety is the #1 core value. The accident prevention programs of Performance Contracting Group, Inc. have been developed to eliminate or mitigate the potential of events that could produce injuries, interrupt production, damage equipment or materials, destroy assets, or escalate the cost of doing business. In order to maintain PCI Solar Energy's stellar safety rating, the project team will identify all potential hazards specific to the San Jose PV Project and produce a site specific "Accident Prevention Plan" as well as activity specific "Activity Hazard Analyses" and "Hazardous Material Control Plan". A pre-construction safety conference will be held on the site and there will be daily safety meetings prior to beginning each day's work to discuss safety concerns specific to the work being performed on that particular day. All emergency procedures will be clearly posted on site as well as all emergency phone numbers, directions to the nearest emergency room, and fire extinguishers.

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Commissioning is a quality-focused process for enhancing the delivery of a project. The process focuses on verifying and documenting that the PV Array and all its interconnecting systems are planned, designed, installed, tested, operated and maintained to meet full operational performance requirements at substantial completion. The purpose of commissioning is to provide a systematic process of assuring by verification and documentation that all PV array and interconnection systems perform interactively in accordance with the Contract Documents and their intent.

PCI and subcontractors will work together to perform system commissioning and start-up activities. Prior to expected PV system start-up, PCI will notify The City of Bisbee and PACE Engineering in writing. PCI and subcontractors will perform start-up testing for each piece of equipment to ensure that the PV Array and interconnecting systems are properly installed and ready for operation, so that functional performance testing may proceed without delay. Commissioning will begin with all system equipment de-energized. This will start at the modules, verifying mechanical and electrical installation specifications. The PV system will be verified up to and including the DC disconnects prior to energizing the inverters. With the inverters energized, the entire PV system can be checked electrically from the modules to the point of utility connection. System testing shall include not only verification that all materials were installed as designed, but also specific electrical tests of PV system to ensure performance meets expected goals. This includes testing and verification of modules, inverters, DC and AC disconnect switches, circuit breaker settings, and protective device settings. System testing shall demonstrate that the commissioned equipment and systems operate properly in all modes of operation. When all individual systems have passed their functional performance tests, PCI and its subcontractors will demonstrate that the systems operate as a whole.

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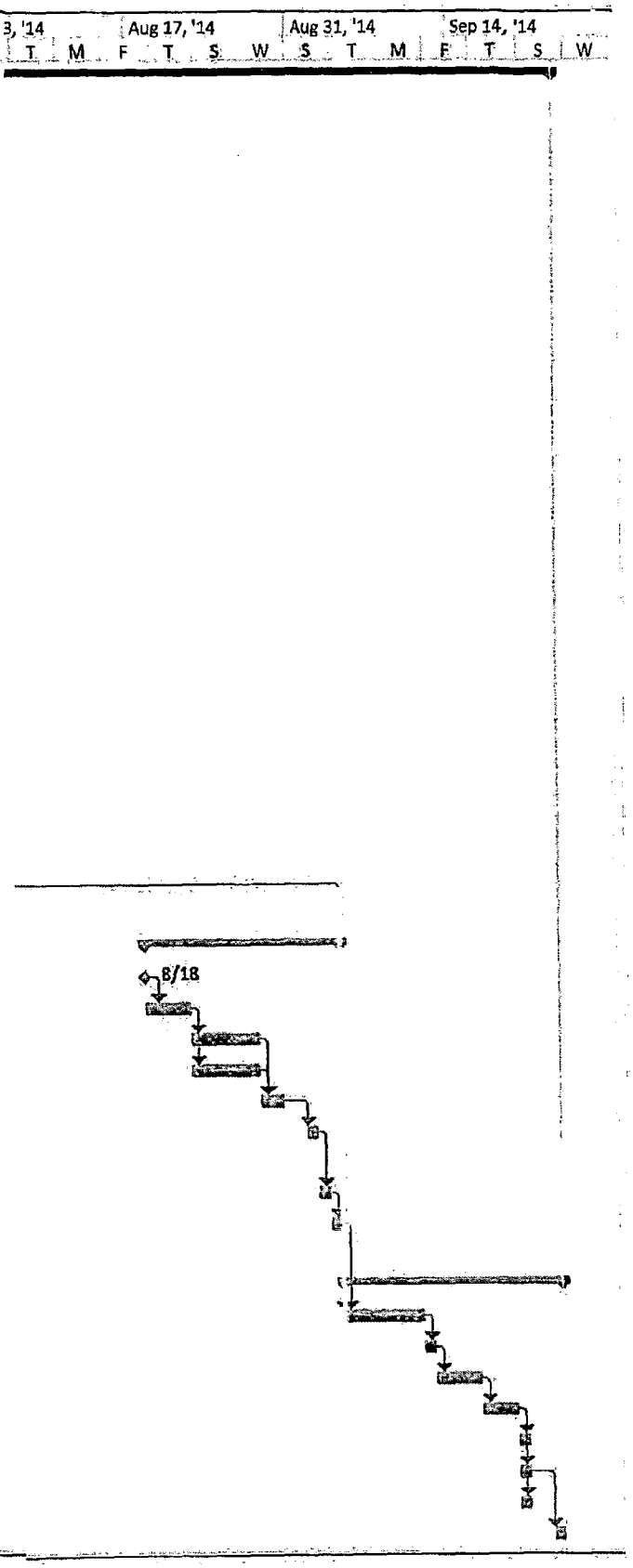
Exhibit A – Construction Schedule

ID	Task Mode	Task Name	Duration
1		**Project Timeline**	**80 days**
2		**Preconstruction Phase**	**23 days**
3		Prepare Initial Design Docs for Permitting	3 days
4		Order Long Lead Materials	20 days
5		Interconnection Agreement	15 days
6		Prepare SWPPP Plan and file	15 days
7		Submittal/ Approvals	2 days
8		Site prep complete	0 days
9		Apply for Permits	10 days
10		**Construction Phase (Main System)**	**18 days**
11		Deliver Port-a-can	1 day
12		Safety Meeting	0 days
13		Prepare lot	1 day
14		Deliver Materials and Equipment/Stage	1 day
15		Install posts	7 days
16		Trenching/ Install Conduit	5 days
17		Install Racking	5 days
18		Install Inverter racks	2 days
19		Install Modules	5 days
20		Install Inverters	5 days
21		Wire panels and DC Combiners	5 days
22		Meg and Terminate/ Interconnection	5 days
23		Weather Delays	3 days
24		Final Interconnection Quality Check	1 day
25		**Wash Bay**	**13 days**
26		Wash Bay Ready for Install	0 days
27		Install Racking	4 days
28		Install Modules	4 days
29		Install Inverters	4 days
30		Wire panels and DC Combiners	2 days
31		Meg and Terminate/ Interconnection	1 day
32		Weather Delays	1 day
33		Final Interconnection Quality Check	1 day
34		**Close Out**	**13 days**
35		Inspections	5 days
36		Meter Installation	1 day
37		Commissioning	2 days
38		Final Walk and Punch	3 days
39		Demobilize and cleanup	1 day
40		Deliver final submittals	1 day
41		Training	1 day
42		Check and Signoff Punchlist	1 day



Project: Bisbee Schedule
Date: Fri 5/16/14

Task
Split
Finish-only
Deadline

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Exhibit B – Bid Bond and Class A License

ARIZONA STATUTORY BID BOND FOR CONSTRUCTION

PURSUANT TO TITLES 28, 34, AND 41, ARIZONA REVISED STATUTES

(Penalty of this bond must not be less than 10% of the bid amount)

KNOW ALL MEN BY THESE PRESENTS THAT: Performance Contracting, Inc.

(hereinafter "Principal") as Principal, and Travelers Casualty and Surety Company of America

(hereinafter "Surety"), a corporation organized and existing under the laws of the State of Connecticut, with its principal offices in the City of Hartford, holding a certificate of authority to transact surety business in Arizona issued by the Director of the Department of Insurance pursuant to Title 20, Chapter 2, Article 1, as Surety, are held and firmly bound unto the **City of Bisbee** (hereinafter "Obligee") in the sum of Ten Percent (10%) of the amount of the bid of the Principal, submitted by Principal to the Obligee for the work described below, for the payment of which sum, the Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents. WHEREAS, the Principal has submitted a bid for:

CW 013-2013A San Jose WWTP Photovoltaic (PV) Solar Power Generation System

NOW, THEREFORE, if the Obligee shall accept the proposal of the Principal and the Principal shall enter into a contract with the Obligee in accordance with the terms of the proposal and give the bonds and certificates of insurance as specified in the standard specifications of Contract documents with good and sufficient surety for the faithful performance of the contract and for the prompt payment of labor and materials furnished in the prosecution of the contract, or in the event of the failure of the Principal to enter into the contract and give the bonds and certificates of insurance, if the Principal pays to the Obligee the difference not to exceed the penalty of the bond between the amount specified in the proposal and such larger amount for which Obligee may in good faith contract with another party to perform the work covered by the proposal then this obligation is void. Otherwise, it remains in full force and effect provided, however, that this bond is executed pursuant to the provisions of Section 34-201, Arizona Revised Statutes, and all liabilities on this bond shall be determined in accordance with the provisions of that section to the extent as if it were copied at length herein.

Witness our hands this 20th day of May, 2014.

Performance Contracting, Inc.
4401 Freidrich Lane, Suite 306, Austin, TX 78744
PRINCIPAL SEAL

By _____
Charles F. Williams
Title: Sr. V.P. / Secretary

Travelers Casualty and Surety Company of America
One Tower Square, Hartford, CT 06183 (860) 277-0111
SURETY SEAL

By _____
(Attorney - in - Fact)
Debra J. Scarborough
Kansas City Series of Lockton Companies, LLC
Agency of Record

444 W. 47th Street, Suite 900, Kansas City, MO 64112-1906 (816) 960-9000
Agency Address

_____
Arizona Resident Agent Countersignature
Gayle Kunkel

WARNING: THIS POWER OF ATTORNEY IS INVALID WITHOUT THE RED BORDER

TRAVELERS

POWER OF ATTORNEY

Farmington Casualty Company
Fidelity and Guaranty Insurance Company
Fidelity and Guaranty Insurance Underwriters, Inc.
St. Paul Fire and Marine Insurance Company
St. Paul Guardian Insurance Company

St. Paul Mercury Insurance Company
Travelers Casualty and Surety Company
Travelers Casualty and Surety Company of America
United States Fidelity and Guaranty Company

Attorney-In Fact No. 227707

Certificate No. 005838590

KNOW ALL MEN BY THESE PRESENTS: That Farmington Casualty Company, St. Paul Fire and Marine Insurance Company, St. Paul Guardian Insurance Company, St. Paul Mercury Insurance Company, Travelers Casualty and Surety Company, Travelers Casualty and Surety Company of America, and United States Fidelity and Guaranty Company are corporations duly organized under the laws of the State of Connecticut, that Fidelity and Guaranty Insurance Company is a corporation duly organized under the laws of the State of Iowa, and that Fidelity and Guaranty Insurance Underwriters, Inc., is a corporation duly organized under the laws of the State of Wisconsin (herein collectively called the "Companies"), and that the Companies do hereby make, constitute and appoint

Patrick T. Pribyl, Debra J. Scarborough, Christy M. McCart, Mary T. Flanigan, Ronald J. Lockton, Claudia Mandato, Jeffrey C. Carey, Kathy L. Fagan, Charles R. Teter III, Laura M. Buhrmester, Charissa D. Lecuyer, Evan D. Sizemore, David M. Lockton, Rebecca S. Gross, Larissa Smith, and Wendy A. Casey

of the City of Kansas City, State of Missouri, their true and lawful Attorney(s)-in-Fact, each in their separate capacity if more than one is named above, to sign, execute, seal and acknowledge any and all bonds, recognizances, conditional undertakings and other writings obligatory in the nature thereof on behalf of the Companies in their business of guaranteeing the fidelity of persons, guaranteeing the performance of contracts and executing or guaranteeing bonds and undertakings required or permitted in any actions or proceedings allowed by law.

IN WITNESS WHEREOF, the Companies have caused this instrument to be signed and their corporate seals to be hereto affixed, this 20th day of March, 2014.

Farmington Casualty Company
Fidelity and Guaranty Insurance Company
Fidelity and Guaranty Insurance Underwriters, Inc.
St. Paul Fire and Marine Insurance Company
St. Paul Guardian Insurance Company

St. Paul Mercury Insurance Company
Travelers Casualty and Surety Company
Travelers Casualty and Surety Company of America
United States Fidelity and Guaranty Company

State of Connecticut
City of Hartford ss.

By: _____
Robert L. Raney, Senior Vice President

On this the 20th day of March, 2014, before me personally appeared Robert L. Raney, who acknowledged himself to be the Senior Vice President of Farmington Casualty Company, Fidelity and Guaranty Insurance Company, Fidelity and Guaranty Insurance Underwriters, Inc., St. Paul Fire and Marine Insurance Company, St. Paul Guardian Insurance Company, St. Paul Mercury Insurance Company, Travelers Casualty and Surety Company, Travelers Casualty and Surety Company of America, and United States Fidelity and Guaranty Company, and that he, as such, being authorized so to do, executed the foregoing instrument for the purposes therein contained by signing on behalf of the corporations by himself as a duly authorized officer.

In Witness Whereof, I hereunto set my hand and official seal.
My Commission expires the 30th day of June, 2016.

MARIE C. TETREAULT NOTARY PUBLIC CONNECTICUT

_____
Marie C. Tetreault, Notary Public

WARNING: THIS POWER OF ATTORNEY IS INVALID WITHOUT THE RED BORDER

This Power of Attorney is granted under and by the authority of the following resolutions adopted by the Boards of Directors of Farmington Casualty Company, Fidelity and Guaranty Insurance Company, Fidelity and Guaranty Insurance Underwriters, Inc., St. Paul Fire and Marine Insurance Company, St. Paul Guardian Insurance Company, St. Paul Mercury Insurance Company, Travelers Casualty and Surety Company, Travelers Casualty and Surety Company of America, and United States Fidelity and Guaranty Company, which resolutions are now in full force and effect, reading as follows:

RESOLVED, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President, any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary may appoint Attorneys-in-Fact and Agents to act for and on behalf of the Company and may give such appointee such authority as his or her certificate of authority may prescribe to sign with the Company's name and seal with the Company's seal bonds, recognizances, contracts of indemnity, and other writings obligatory in the nature of a bond, recognizance, or conditional undertaking, and any of said officers or the Board of Directors at any time may remove any such appointee and revoke the power given him or her; and it is

FURTHER RESOLVED, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President may delegate all or any part of the foregoing authority to one or more officers or employees of this Company, provided that each such delegation is in writing and a copy thereof is filed in the office of the Secretary; and it is

FURTHER RESOLVED, that any bond, recognizance, contract of indemnity, or writing obligatory in the nature of a bond, recognizance, or conditional undertaking shall be valid and binding upon the Company when (a) signed by the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary and duly attested and sealed with the Company's seal by a Secretary or Assistant Secretary; or (b) duly executed (under seal, if required) by one or more Attorneys-in-Fact and Agents pursuant to the power prescribed in his or her certificate or their certificates of authority or by one or more Company officers pursuant to a written delegation of authority; and it is

FURTHER RESOLVED, that the signature of each of the following officers: President, any Executive Vice President, any Senior Vice President, any Vice President, any Assistant Vice President, any Secretary, any Assistant Secretary, and the seal of the Company may be affixed by facsimile to any Power of Attorney or to any certificate relating thereto appointing Resident Vice Presidents, Resident Assistant Secretaries or Attorneys-in-Fact for purposes only of executing and attesting bonds and undertakings and other writings obligatory in the nature thereof, and any such Power of Attorney or certificate bearing such facsimile signature or facsimile seal shall be valid and binding upon the Company and any such power so executed and certified by such facsimile signature and facsimile seal shall be valid and binding on the Company in the future with respect to any bond or understanding to which it is attached.

I, Kevin E. Hughes, the undersigned, Assistant Secretary, of Farmington Casualty Company, Fidelity and Guaranty Insurance Company, Fidelity and Guaranty Insurance Underwriters, Inc., St. Paul Fire and Marine Insurance Company, St. Paul Guardian Insurance Company, St. Paul Mercury Insurance Company, Travelers Casualty and Surety Company, Travelers Casualty and Surety Company of America, and United States Fidelity and Guaranty Company do hereby certify that the above and foregoing is a true and correct copy of the Power of Attorney executed by said Companies, which is in full force and effect and has not been revoked.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed the seals of said Companies this MAY 20 2014 day of _____, 20 ___.

Kevin E. Hughes, Assistant Secretary

To verify the authenticity of this Power of Attorney, call 1-800-421-3880 or contact us at www.travelersbond.com. Please refer to the Attorney-In-Fact number, the above-named individuals and the details of the bond to which the power is attached.

DISCLAIMER

The data supplied below is based on your specific request(s) and is correct to the best of our knowledge as of the date and time it was extracted from our data files. The information is provided without personal research or analysis. The data is subject to change on a daily basis. You may obtain additional public records related to any licensee, including dismissed complaints and nondisciplinary actions and orders, by contacting the ROC directly. If this information is required for legal purposes, you may request an affidavit or certified copies for a fee as specified in **A.R.S. 32-1104A3**. Please read our Standard Disclaimer at **www.azroc.gov/Legal/Disclaim.html**

Please note: The company or individuals listed on this license may hold other Arizona contracting licenses. To view information, status and complaint history for the past two years on other licenses held, go to the License Inquiry page and do a "Company Name and Personnel" search by entering the name of the company or individuals listed on the license.

Details for License Number 266503 (Friday, May 16, 2014 2:02:40 PM)

Contractor		License	
Name/Address/Phone	Status/Action	Class | Type | Entity	Issued/Renewal
Briston Construction LLC 309 E 10th Dr Mesa, AZ 85210-8706 Phone: (480) 776-5810	CURRENT	KA | DUAL | LLC	First Issued: 07/16/2010 Renewed Thru: 07/31/2014

License Class & Description KA DUAL ENGINEERING

Qualifying Party and Personnel

The Qualifying Party listed below is associated with this license. All other persons named, if any, are associated with the company. They are not all necessarily associated with this license.

Name	Daniel Lee Briscoe	Name	Brandon Pearson Carr
Position	QP/MEMBER	Position	MEMBER
Qual Date 08/01/2012			

Complaint Information

*Complaints against this contractor are listed below. Complaints that were cancelled, resolved or settled without a corrective work order or dismissed are not included. Contact the **Registrar of Contractors at 602-542-1525 or toll-free statewide at 1-877-MY AZROC (1-877-692-9762)** to identify the ROC office location you need to visit to view complete complaint documentation.*

Open:	0	This is the number of complaints against this contractor that are currently open except those in which an agency inspection has not occurred or a violation was not found. Upon adjudication some complaints are found to be without merit and are dismissed.

Closed Cases

Disciplined:	0	This is the number of times this license has been disciplined.
Resolved/Settled/ Withdrawn:	0	This is the number of complaints closed against this contractor that were resolved or settled by the contractor or withdrawn by the complainant after issuance of a corrective work order or formal citation.
Denied Access:	0	This is the number of complaints against this contractor that were closed without corrective work being performed because the contractor was denied access by the complainant.

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Exhibit C – Receipt of Addenda

RECEIPT OF ADDENDA

(Must be submitted with the Bid)

CW 013-2013A SAN JOSE WWTP PHOTOVOLTAIC (PV) SOLAR POWER GENERATION SYSTEM

In compliance with the Advertisement for Bids, by the Public Works Director, the undersigned Bidder:

Having examined the contract documents, site of work, and being familiar with the conditions to be met, hereby submits the following Proposal for furnishing the material, equipment, labor and everything necessary for the completion of the work listed, and agrees to execute the contract documents and furnish the required bonds and certificates of insurance for the completion of said work at the locations and for the prices set forth on the inside pages of this form.

Understands that construction of this project shall be in accordance with all applicable Uniform Standard Specifications and Standard Details except as otherwise required by the Project Plans and Special Provisions.

Understands that his proposal shall be submitted with a proposal guarantee of cash, certified check, cashier's check or surety bond for an amount not less than ten percent (10%) of the amount bid.

Agrees that upon receipt of Notice of Award from the City of Bisbee, he shall execute the contract documents.

Agrees that all work on Project CW 013-2013A SAN JOSE WWTP PHOTOVOLTAIC (PV) SOLAR POWER GENERATION SYSTEM shall be completed by the following dates; substantially completed by 120 calendar days from NTP, with final completion by 14 calendar days following Substantial Completion. The time allowed for completion of the work includes lead time for obtaining the necessary material and/or equipment.

The Bidder hereby acknowledges receipt of and agrees his proposal is based on the following addenda:

Addendum No. 1, Dated May 12, 2014

Addendum No. _____, Dated _____

Addendum No. _____, Dated _____

Addendum No. _____, Dated _____

_____
(Signature)

Senior Sales Engineer, Performance Contracting, Inc.
(Title)

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Exhibit D – Non-Collusion Affidavit

NON-COLLUSION AFFIDAVIT

(Must be submitted with the Bid)

CW 013-2013A SAN JOSE WWTP PHOTOVOLTAIC (PV)
SOLAR POWER GENERATION SYSTEM

I certify that this bid is genuine and is not in any way collusive or sham; that the bid is not made with the intent to restrict or prohibit competition, that this firm has not revealed the contents of the bid to, or in any way colluded with, any other firm which may compete for the contract; and that no other firm which may compete for the contract has revealed the contents of a bid to, or in any way colluded with, this firm.

Name of Firm Submitting Bid Performance Contracting, Inc

Address 4401 Freidrich Lane #306

Austin, TX 78744

Telephone Number: 512-443-0535

Facsimile Number: 512-443-3404

Authorized Signature

This affidavit is required pursuant to Arizona Revised Statutes 34-253 and 41-2549. Failure to submit this affidavit signed at the time of bid opening is grounds for disqualification of the bid.

State of TEXAS)
)ss
County of TRAVIS)

Before me a Notary Public in and for said County and State personally appeared the above named who signed the foregoing affidavit and attested that the same was his free act and deed.

Dated this 16 day of May 2014.

MISTY WHITE
Notary Public, State of Texas
My Commission Expires
April 22, 2018

Misty White
Notary Public

My Commission expires 4/22/18.

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SOLAR ENERGY

Exhibit E – Bid Proposal

City of Bisbee
CW 013-2013A
SAN JOSE WWTP PHOTOVOLTAIC (PV) SOLAR POWER GENERATION SYSTEM
Proposal Form

1. The Undersigned Bidder declares that he has read the Specifications and other Contract Documents, has examined and understands the Plans, has examined the site of the work and has determined for himself the conditions affecting the work, and he proposes and agrees if this Proposal is accepted, to provide at his own expense, all labor, insurance, superintendence, machinery, plant, equipment, tools, apparatus, appliances, and means of construction, and all materials and supplies and to complete, ready for its intended purpose, the entire work and all parts thereof described as included under the Contract herein bid upon, in the manner and items prescribed, including all work incidental thereto, according to the Plans and Specifications and such instructions as the City of Bisbee's authorized agent may give.

2. The Undersigned Bidder, in compliance with your Notice Inviting Bids dated TBD, hereby proposes to do the work called for in said Specifications and other Contract Documents and shown on said Plans for the said work at the following rates and prices:

BID SCHEDULE

ITEM		AMOUNT DOLLARS & CENTS
Base Bid (Required)	**Please specify included in Base Bid** (circle one for each equipment type): **Panels:** (Canadian Solar) Central Solar Solar World **Inverters:** Power-One SMA Sunny Tripower	$ 1,039,349

Bid Alternates (Optional):
Bidder has the opportunity to provide bid alternates. If elected, please fill out the line items below, specify ***manufacturer/model (if applicable), and attach cut sheets*** for proposed equipment. Engineer shall review proposed alternates to ensure equipment is "or equal" to the Base Bid specifications. The Engineer and City will determine which alternates will be accepted to include in overall bid price.

ITEM		ADD OR DEDUCT AMOUNT
Panel Bid Alternate (Optional)	**Manufacturer/model of proposed alternate** (please specify): Conergy 250P	$ (13,333.33)
Inverter Bid Alternate (Optional)	**Manufacturer/model of proposed alternate** (please specify):	$
Footing Bid Alternate (Optional)	Pile Driven Footing in lieu of Concrete Base	

Combined Bid Impact (Optional):
If Bidder is selected to perform both CW 013-2013A and CW 013-2013B, Bidder shall provide below the impact (add or deduct) of this Bid amount.

ITEM	ADD OR DEDUCT IMPACT AMOUNT
Combined Bid Impact (Optional) **Impact in Total CW 013-2013A Project Price**	$

3a. PROPOSAL QUANTITIES. It is expressly understood and agreed by the parties hereto that the proposal quantities of the various classes of work to be done and material to be furnished under this Contract, which have been estimated as stated in the Proposal, are only approximate and are to be used SOLELY for the purpose of comparing, on a consistent basis, the proposals offered for the work under this Contract; and the Contractor further agrees that the City of Bisbee will not be held responsible if any of the quantities shall be found incorrect; and the Contractor will not make any claim for damages or for loss of profits because of a difference between the quantities of the various classes of work as estimated and the work actually done.

3b. PROPOSAL QUANTITIES. If any error, omission, or misstatement is found to occur in the estimated quantities, the same shall not invalidate this Contract or release the Contractor from the execution and completion of the whole or any part of the work in accordance with the Project Specifications and Contract Documents and the Plans herein mentioned, or for the prices herein agreed upon and fixed therefore, or excuse him from any of the obligations or liabilities hereunder, or entitle him to any damages or compensation except as may be provided for in this Contract.

4. The undersigned agrees, upon written notice of the acceptance of this bid, within ninety (90) days after the opening of the bids, that he will execute the Contract in accordance with the bid as accepted and give contract (Performance and Payment) Bonds on the forms included herein within fifteen (15) days after the prescribed forms are presented for signature.

5. The undersigned further agrees that if awarded the Contract, he will commence work within fifteen (15) calendar days after receipt of Notice to Proceed and that the work will be shall be completed according to the contract times; within 120 days of the NTP. Liquidated Damages apply if any of these completion dates are not met. The Contractor shall pay liquidated damages for each missed completion date in accordance with Paragraph 5 of the Special Provisions, in the amount of Five Hundred Seventy Dollars ($5,70.00) for each calendar day the work remains uncompleted after the designated completion dates.

6. As an evidence of good faith in submitting this proposal, the undersigned encloses a certified check, cashier's check or bid bond in the amount not less than ten percent (10%) of the total amount of the bid, which, in case he refuses or fails to accept an award and to enter into a contract and file the required bonds within the prescribed time, shall be forfeited to the City of Bisbee, as liquidated damages.

7. The undersigned hereby declares that the only parties interested in this proposal are named herein, that this proposal is made without collusion with any other person, firm or corporation, that no employee of the City of Bisbee, officer or agent, is directly or indirectly financially

8. The undersigned understands that this agreement may be cancelled by the City of Bisbee for conflict of interest pursuant to Arizona Revised Statutes Section 38-511.

9. The undersigned has checked carefully all the above figures and understands that the City of Bisbee, will not be responsible for any errors or omissions on the part of the undersigned in making up this bid.

10. The undersigned understands that the City of Bisbee, reserves the right to reject any or all bids or to waive any informalities in the bid.

THIS PROPOSAL IS SUBMITTED BY Performance Contracting, Inc, a corporation organized under the laws of the State of Kansas, a partnership consisting of NA, or an individual trading as NA of the City of Lenexa and is the holder of Arizona State Contractor's License:

Classification B-1 No. 83336

****using subcontractor's A class for permitting***

Respectfully Submitted

FIRM: Performance Contracting, Inc

BY: _____ (signature)

ADDRESS: 4401 Freidrich Lane, Ste 306

Craig Alan Floyd
Name (print or type)

Austin, TX 78744

Operations Manager
Title (print or type)

DATE: 5/16/14

ATTEST:

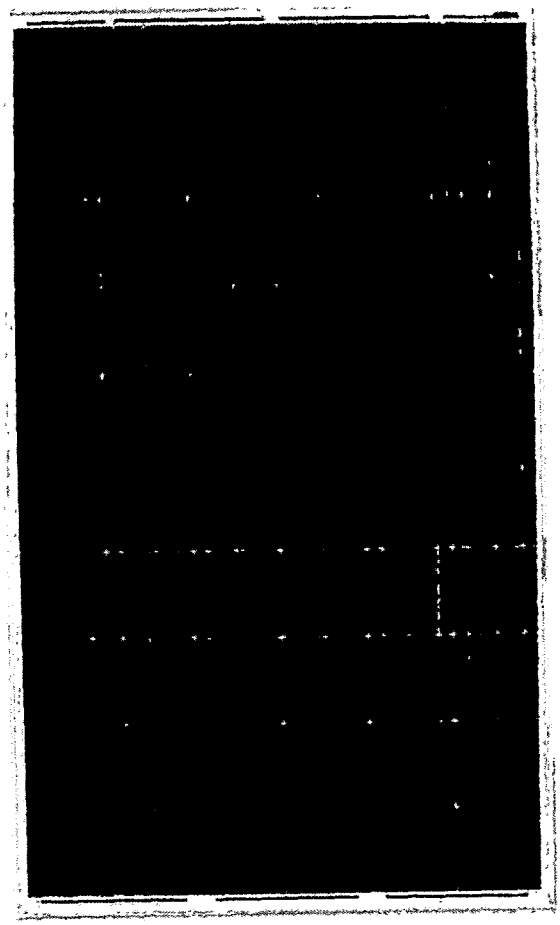
Misty White, Notary
Officer and Title

Witness: If Bidder is an Individual

MISTY WHITE
Notary Public, State of Texas

Conergy PH 225P-250P

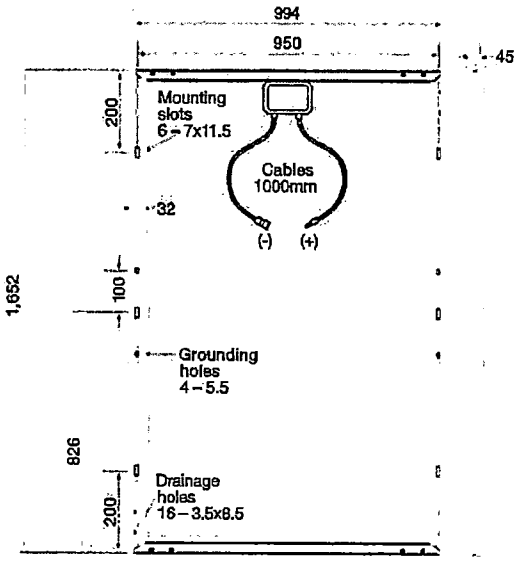
Conergy PH Series modules offer high output levels at an attractive price/performance ratio. Equipped with 60 efficient polycrystalline cells, Conergy PH is characterized by high yields and a long service life. Conergy PH production is certified to ISO 9001 international quality standards, and Conergy continually monitors the production process to insure product quality. These modules are powerful and versatile enough for any application from residential through utility scale.



Features:

- Attractive price/performance ratio
- 3 busbar cell design for better efficiency and yield
- Precision, +3% power tolerance
- 10-year product warranty
- PV wire cables for use with transformerless inverters
- Certified to UL 1703 (US and Canada), IEC/EN 61215 Ed.2, IEC/EN 61730

Conergy PH 225P-250P



All dimensions in mm

Module dimensions (L x W x H)	1652 x 994 x 45mm / 65.0 x 39.1 x 1.8 in
Cell dimensions	156 x 156 mm/6.14 x 6.14 in
Number of cells	60
Module weight	20kg/44.1lb
Maximum load	5400Pa/113psf
Glass	3.2mm tempered
Junction box	IP65 Class
Cable	1000mm/39.4 in, 4mm² 12AWG PV wire (UL4703)
Connector	MC4 Compatible
Certifications	
Operating certifications	UL1703 (USA and Canada), IEC 61215 Ed.2
Fire safety classification	Class C
Warranty	
Material and workmanship warranty	10 years
Power warranty 1	90%/10 years
Power warranty 2	80%/25 years

	Conergy PH Series					
	225P	230P	235P	240P	245P	250P
Rated power (P_{max})[1]	225W	230W	235W	240W	245W	250W
Power tolerance	+3%	+3%	+3%	+3%	+3%	+3%
Module efficiency	13.7%	14.0%	14.3%	14.6%	14.9%	15.2%
Maximum power voltage (V_{mpp})	28.4V	28.8V	29.2V	29.5V	29.92V	30.30V
Maximum power current (I_{mpp})	7.92A	7.99A	8.06A	8.13A	8.20A	8.27A
Open circuit voltage (V_{oc})	37.1V	37.4V	37.6V	37.8V	37.98V	38.19V
Short circuit current (I_{sc})	8.48A	8.53A	8.56A	8.59A	8.62A	8.65A
Nominal Operating Cell Temperature (NOCT)	43±2°C					
Temperature coefficient (P_{max})	-0.47%/°C					
Temperature coefficient (V_{oc})	-0.34 %/°C					
Temperature coefficient (I_{sc})	0.05 %/°C					
Maximum system voltage	600V(UL)/1000V (IEC)					
Maximum Series Fuse Rating	15A					

[1] At Standard Test Conditions (STC): 1000W/m², 25°C, air mass 1.5

Conergy PH 225P I-V Curves

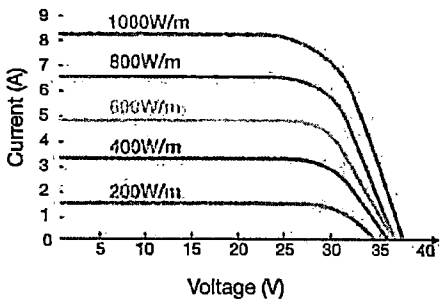


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Exhibit F – Bidders Checklist

IMPORTANT

BIDDER'S CHECK LIST
PROJECT NO. CW 013-2013A
SAN JOSE WWTP PHOTOVOLTAIC (PV) SOLAR POWER GENERATION SYSTEM

Check off each of the following as the necessary action is completed.

☑ **Enclose Bid Bond (per sample provided)..... Page 83**

☑ **All required forms/documentation are included.**

NOTE: The following pages MUST be submitted for a bid to be considered responsive

☑ **Receipt of Addenda..... Page 90**
☑ **Non-Collusion Affidavit..... Page 91**
☑ **Bid Proposal ..... 3 Pages**

NOTE: The Bidder may retain the remainder of the Bid Packet if desired.

☑ The bid prices offered have been reviewed.

☑ The price extensions and totals have been checked.

☑ The bid has been signed.

☑ The mailing envelope has been addressed to:

City of Bisbee
Attention: City Clerk
Address: 118 Arizona Street, Bisbee, Arizona 85603

☑ The mailing envelope has been sealed and marked on the outside with:

Bid of Performance Contracting, Inc,.Contractor
Project Number: CW 013-2013A
Bid Title: SAN JOSE WWTP PHOTOVOLTAIC (PV)
SOLAR POWER GENERATION SYSTEM
Opening Date and Time: **Tuesday, May 20, 2014 at 2:00 PM (Arizona Time)**

NOTE: The bid must be mailed or delivered in time to be received no later than the designated opening date and time. (Otherwise the bid shall be returned unopened.)

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Exhibit G – DBE Good Faith Effort

United States Environmental Protection Agency

OMB Control No: 2090-0030
Approved: 8/13/2013
Approval Expires: 8/31/2015

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Performance Form

This form is intended to capture the DBE[1] subcontractor's[2] description of work to be performed and the price of the work submitted to the prime contractor. An EPA Financial Assistance Agreement Recipient must require its prime contractor to have its DBE subcontractors complete this form and include all completed forms in the prime contractors bid or proposal package.

Subcontractor Name		Project Name
Briston Construction, LLC		
Bid/ Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact
CW0132013A	N/A	Daniel Briscoe
Address		
309 E. 10th Drive, Mesa, AZ 85210		
Telephone No.		Email Address
(480)776-5810		dbriscoe@bristonconstruction.com
Prime Contractor Name		Issuing/Funding Entity:
PCI Solar		

Contract Item Number	Description of Work Submitted to the Prime Contractor Involving Construction, Services, Equipment or Supplies	Price of Work Submitted to the Prime Contractor
	Electrical Scope including PV Panel Installation	$ 350,000.00

DBE Certified By:	Meets/ exceeds EPA certification standards?
○ DOT ○ SBA ◉ Other: SDVOSB--CVE Certified-Dept. of VA	○ YES ○ NO ◉ Unknown

[1] A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

[2] Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.

EPA United States Environmental Protection Agency

OMB Control No: 2090-0030
Approved: 8/13/2013
Approval Expires: 8/31/2015

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Performance Form

I certify under penalty of perjury that the forgoing statements are true and correct. Signing this form does not signify a commitment to utilize the subcontractors above. I am aware of that in the event of a replacement of a subcontractor, I will adhere to the replacement requirements set forth in 40 CFR Part 33 Section 33.302 (c).

Prime Contractor Signature	Print Name
	Craig Alan Floyd
Title	**Date**
Operations Manager	5/16/14

Subcontractor Signature	Print Name
	Daniel Briscoe
Title	**Date**
CEO, Briston Construction, LLC	16 May 14

United States Environmental Protection Agency

OMB Control No: 2090-0030
Approved: 8/13/2013
Approval Expires: 8/31/2015

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Utilization Form

This form is intended to capture the prime contractor's actual and/or anticipated use of identified certified DBE[1] subcontractors[2] and the estimated dollar amount of each subcontract. An EPA Financial Assistance Agreement Recipient must require its prime contractors to complete this form and include it in the bid or proposal package. Prime contractors should also maintain a copy of this form on file.

Prime Contractor Name		Project Name
Performance Contracting, Inc		San Jose WWTP Photovoltaic (PV) Solar Power G
Bid/ Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact
CW 013-2013A	NA	Craig Alan Floyd
Address		
4401 Freidrich Lane #306, Austin, TX 78744		
Telephone No.		Email Address
512-443-0535		craig.floyd@pcg.com
Issuing/Funding Entity:		
City of Bisbee		

I have identified potential DBE certified subcontractors	◉ YES	○ NO

If yes, please complete the table below. If no, please explain:

Subcontractor Name/ Company Name	Company Address/ Phone/ Email	Est. Dollar Amt	Currently DBE Certified?
Briston Construction	309 E 10th Dr. Mesa, AZ 85210	$ 350,000.00	Yes

Continue on back if needed

[1] A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

[2]

EPA United States Environmental Protection Agency

OMB Control No: 2090-0030
Approved: 8/13/2013
Approval Expires: 8/31/2015

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Utilization Form

I certify under penalty of perjury that the forgoing statements are true and correct. Signing this form does not signify a commitment to utilize the subcontractors above. I am aware of that in the event of a replacement of a subcontractor, I will adhere to the replacement requirements set forth in 40 CFR Part 33 Section 33.302 (c).

Prime Contractor Signature	Print Name
	Craig Alan Floyd
Title	**Date**
Operations Manager	5/16/14

PCI
PERFORMANCE CONTRACTING INC
SOLAR ENERGY

Exhibit H – Contract Clarifications

PERFORMANCE CONTRACTING INC

CITY OF BISBEE
Project No. CW 013-2013A
SAN JOSE WWTP PHOTOVALTAIC (PV) SOLAR POWER GENERATION STATION

Bid Clarifications

PERFORMANCE CONTRACTING, INC. (the "Contractor") offers the following clarifications to the contract terms and conditions for **CITY OF BISBEE**, for the bid for construction on the captioned Project. Notwithstanding any language in the contract documents to the contrary, the provisions of these Clarifications shall be controlling in the event of any discrepancies, inconsistencies or ambiguities between these Clarifications and any other contract document. References in these Clarifications to specific sections in the Contract are by way of illustration and not intended to limit the applicability of provisions contained herein.

1. Contractor shall not assume risk of loss for its installed work or be responsible for any damage to, loss or destruction of its work by others, weather or environmental conditions. If repairs to installed work are made necessary by the actions or inactions of others, or due to any cause beyond Contractor's control, Contractor shall be reimbursed for the costs in performing such repair or replacement work. If such repair work is necessitated by the acts or omissions of Contractor, such work shall be performed at Contractor's expense. *Reference Articles 1, 13.*

2. Contractor's responsibility for liquidated or other damages resulting from delay shall be limited to the extent that Contractor is the direct cause of the event giving rise to the imposition of such damages, and Contractor will in no event be liable or responsible for any consequential, incidental or special damages of any kind. *Reference Articles 3, 11.*

3. Contractor shall make a reasonable inspection of the previous work of other trades as it directly relates to the incorporation of Contractor's work. However, Contractor shall not be responsible for detecting hidden or latent errors in the work of others and shall receive reasonable compensation for costs or damages it incurs relating to such prior work. *Reference Articles 4, 9.*

4. Contractor's obligations of indemnification and defense shall be only to the extent of the negligence or willful misconduct of Contractor or Contractor's lower tier subcontractors. Contractor shall have no obligation to indemnify or defend the Owner from their own negligence or willful misconduct or the negligence and willful misconduct of those under their control. In no event shall Contractor be responsible for the costs of indemnity or defense of Owner unless and until it is determined that Contractor is, in whole or in part responsible for the damages sought, and then only to the extent of the negligence or willful misconduct of Contractor or Contractor's lower tier subcontractors. *Reference Article 7*

5. In the event Contractor is interrupted, delayed, disrupted, suspended, obstructed or is otherwise required to accelerate or resequence its work for reasons other than the fault of Contractor or others under Contractor's control, or where Owner directs Contractor to accelerate or resequence its work for the convenience or benefit of Owner, Contractor shall be entitled to additional compensation, an extension of time or both. *Reference Article 11*

6. Any special insurance coverage, including primary coverage to additional insureds, referenced endorsements or waivers of subrogation, provided by Subcontractor's insurer pursuant to the insurance requirements of the contract documents shall be applicable only to the extent of Subcontractor's indemnification obligations. *Reference Article 14*

7. In lieu of the CG 2010 (11/85) endorsement for sole negligence coverage, Contractor will provide the CG 2010 (07/04) and CG 2037 (07/04) endorsements. *Reference Article 14.*

8. Contractor's obligation to indemnify the Contractor and Owner against claims against the property, and any waiver of lien rights, shall apply only to the extent that Contractor has been paid for its work.

Engineering Specifications

City of Bisbee
CW 013-2013A San Jose WWTP Photovoltaic (PV) Solar Power Generation System

April 2014

Prepared For:

City of Bisbee
118 Arizona St.
Bisbee, AZ 85603

Prepared by:

Pacific Advanced Civil Engineering, Inc.
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Scottsdale, AZ 85250

Registered Professional Engineer (Civil)
CERTIFICATE NO.
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DO
Date Signed 4-14-2014
ARIZONA, U.S.A.

Exp. 12-31-2015

Contact Person:
Duong Do, PE
Mike Krebs, PE

PACE JN A364

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SECTION 00700
SPECIAL CONDITIONS

PART 1 – GENERAL

1.1 CONTRACT DOCUMENTS

The Contract Documents which constitute the contract between the OWNER and the CONTRACTOR with regard to the subject matter as set forth in Section I of such contract ("Contract Agreement") and include the Contract Agreement, plans, drawings, and the technical specifications.

All terms and conditions established in the Contract Agreement shall supersede all general conditions of these specifications to be followed in the event of any conflict or discrepancies.

1.2 DEFINITIONS AND MEANINGS OF TERMS

Whenever in the Contract Documents the following terms or pronouns referring to them are used, the intent and meaning shall be interpreted as follows which shall be applicable to both the singular and plural thereof:

A. The Contract shall mean the Contract executed by the OWNER and the CONTRACTOR, of which these General Conditions form a part; the terms Contract and Agreement are synonymous.

B. The term OWNER shall mean the respective party to the Contract; the OWNER being the City of Bisbee. The term OWNER may also mean consultants, engineers, or other professionals contracted by the OWNER to review, supervise, or consult on the project.

C. The term County shall mean Cochise County, AZ.

D. The term CONTRACTOR shall mean the respective party to the contract.

E. The term SUBCONTRACTOR shall mean any individual, partnership or corporation having a direct contract with the CONTRACTOR to perform any part of the work.

F. The term ENGINEER shall mean Pacific Advanced Civil Engineering, Inc. (PACE).

G. Addenda shall mean written or graphic instruments issued prior to the execution of the Agreement which modify or interpret the Contract Documents, Final Design Plans, by additions, deletions, clarifications or corrections.

H. Bonds shall mean Performance and Payment Bonds and other instruments of security, furnished by the CONTRACTOR and its surety in accordance with the Contract Documents.

I. Change Order shall mean a written order to the CONTRACTOR authorizing an addition, deletion or revision in the Work within the general scope of the Contract Documents, or authorizing an adjustment in the Contract price or Contract time.

J. Contractual Agreement shall mean the signed agreement between the OWNER and the CONTRACTOR for the work intended.

K. Contract Documents shall have the meaning described in Section 1.1 herein.

L. Contract price shall mean the total monies payable to the CONTRACTOR under the terms and conditions of the Contract Documents.

M. Contract time in days shall mean the number of consecutive calendar days stated in the Contract Documents for the completion of the Work.

N. Drawings shall mean the part of the Contract Documents, which show the characteristics and scope of the Work to be performed and which have been prepared or approved by the ENGINEER.

O. Notice to proceed shall mean written communication issued by the OWNER to the CONTRACTOR authorizing him to proceed with the Work and establishing the date of commencement of the Work.

P. Project shall mean the undertaking to be performed as provided in the Contract Documents.

Q. Submittals shall mean all drawings, diagrams, illustrations, brochures, schedules and other data which are prepared by the CONTRACTOR, a subcontractor, manufacturer, supplier or distributor, which illustrate how specific portions of the Work shall be fabricated or installed; the terms shop drawings and submittals are synonymous.

R. Specifications shall mean a part of the Contract Documents consisting of written descriptions of a technical nature of materials, equipment, construction systems, standards and workmanship.

S. Substantial completion shall have the meaning defined in the Contract Agreement.

T. Suppliers shall mean any person, supplier or organization who supplies materials or equipment for the Work, including that fabricated to a special design, but who does not perform labor at the site.

U. Work shall mean all (i) obligations, responsibilities and duties undertaken by the CONTRACTOR in order to successfully construct, complete and operate (for Startup Completion) the Project, including all labor, materials, equipment and other incidentals, and the furnishing thereof, (ii) Design and Engineering Services, (iii) Training Services, and (iv) Initial Operations, pursuant to the Contract Documents.

V. Written notice shall mean any notice to any party of the Agreement relative to any part of this Agreement in writing and considered delivered and the service thereof completed, when posted by certified or registered mail to the said party at his last given address, or delivered in person to said party of his authorized representative on the Work.

W. Engineering Supplemental Information (ESI) shall mean written communications issued by the ENGINEER to the CONTRACTOR providing the CONTRACTOR with additional clarifications of the Contract Documents that the ENGINEER deem necessary to ensure the design intent.

X. Request for Information (RFI) shall mean written communications issued by the CONTRACTOR to the ENGINEER requesting additional information or clarification regarding a specific item in the Contract Documents.

1.3 CONTRACTOR'S RESPONSIBILITY

A. **General:** It is the responsibility of the CONTRACTOR and each subcontractor to visit the site and satisfy himself as to the various existing conditions affecting the work as required.

B. **Underground Utilities:** The information shown on the drawings was obtained from drawings furnished by the OWNER, and surveys furnished to the OWNER. The CONTRACTOR shall make such investigation as deemed necessary to be satisfied as to the actual location, size, type of material, buried depth, and other factors relating to these services.

1.4 PERMITS, FEES, AND SALES TAX

A. The CONTRACTOR shall submit the required fees, drawings and application for the applicable permits prior to commencement of work.

B. A summary of local permits are as follows:

1. City of Bisbee
   a. Building Permit
   b. Grading Permit
2. SWPPP – NOI, BMP Plan & Monitoring Plan per Section 01565
3. Dust Control – Per Section 01563
4. This Permit summary is provided for convenience to the CONTRACTOR and does not relieve the CONTRACTOR from the responsibility of obtaining any additional required Permit not listed for the construction of this facility.

C. The CONTRACTOR will be required to obtain a City of Bisbee Business License and submit to the ENGINEER for his records prior to the issuance of any NTP.

D. CONTRACTOR shall pay all sales tax applicable to the work.

1.5 PRE-CONSTRUCTION MEETING

A. General: Before issuance of Notice to Proceed, a pre-construction meeting shall be held at the location, date and time designated by ENGINEER and OWNER. Attendees shall include the ENGINEER, OWNER's representatives, General CONTRACTOR's project manager and field superintendent, and representatives from each subcontractor for the project as appropriate.

1.6 CONSTRUCTION PROGRESS MEETINGS

A. Progress meetings shall be held according to the agreed upon schedule. All matters bearing on progress and performance of the work since preceding progress meeting shall be discussed and resolved including, without limitation, any previously unresolved matters, deficiencies in the work or methods being employed for the work, and problems, difficulties, or delays which may be encountered.

1.7 PROTECTION OF WORK

A. CONTRACTOR shall provide all protection required to insure that all work completed will not be harmed.

B. The CONTRACTOR may at his option and expense install any lawful security measures he deems necessary to protect his materials, equipment or finished work. Type of security devices or quantity shall be the sole responsibility of the CONTRACTOR. The CONTRACTOR is to provide security and protect the project until the OWNER has occupied the space or OWNER has accepted the space.

C. Protection:

1. The CONTRACTOR shall be solely responsibility for the protection of all materials and work.
2. The CONTRACTOR shall include in his proposal the cost of any temporary partitions, sheathing, plastic covering, etc., as may be required to maintain affected areas. Remove all such temporary work at the proper time during the construction period and repair all damage related to same.
3. The CONTRACTOR is solely responsible for the protection of the area in which work is being performed.

4. Provide construction fencing as required to secure the site (See also section 01561, Temporary Fencing).

1.8 ACCESS TO SITE

A. All access to the site by the General CONTRACTOR, Subcontractors, workmen, material/equipment suppliers, etc., shall be via approved access locations as designated by the OWNER. All vehicular or equipment activity shall be strictly confined to the construction limits as indicated by OWNER.

B. Remove all temporary construction and temporary facilities at close of the job or when no longer needed.

1.9 MATERIALS TESTING

A. All materials to be incorporated into the work shall be subject to sampling, testing, and approval as required by specifications. CONTRACTOR shall be responsible for retaining the services of an independent testing agency for special inspections.

B. All materials and/or equipment shall be handled in such a manner as to preserve their quality and fitness for the work.

C. Unless otherwise specified, samples and tests shall be made in accordance with either: the Standard Methods of AASHTO, ASTM, ASME, or ADOT which were in effect and published at the time of advertising for bids. The laboratory responsible for the test(s) shall furnish at least one copy of the test results to the CONTRACTOR, the ENGINEER, and to the appropriate material supplier.

D. All materials and/or equipment not conforming to the requirements of the Specifications, whether in place or not, will be rejected. Rejected materials and/or equipment shall be removed immediately from the site of work unless otherwise permitted by the ENGINEER. No rejected material and/or equipment, the defects of which have been subsequently corrected, shall be used until approved in writing by the ENGINEER. CONTRACTOR shall be responsible for re-testing of all rejected materials.

1.10 SPECIAL INSPECTIONS

A. Various categories for inspection/ observation of work progress during the course of construction are listed, but not limited to specifications and notes in the drawings. The OWNER requires on-site observation of the work at these various stages prior to covering the work. A list of such inspections will be reviewed at the Pre-Construction Conference and subsequent job meetings, and it is understood that the CONTRACTOR will not cover work until such observation has been completed. The OWNER and OWNER representatives will be responsible for reasonable cooperation with CONTRACTOR requests for observation of the work. The CONTRACTOR shall include anticipated observation requests at weekly update of scheduled activities.

1.11 PRIOR APPROVALS

A. If the General or Prime CONTRACTOR wishes to use items of equipment and/or materials other than those identified in the drawings or specifications, a written request for approval shall be submitted to the ENGINEER prior to the confirmation of contract price. Any request submitted after this time are not under obligation to be accepted. Request from subcontractors will not be considered.

B. Proposed substitutions that have not received prior approval are undertaken at the CONTRACTOR's risk to be deemed equivalent during the construction submittal process.

C. Each request shall include all basic data and characteristics clearly legible. The specified item as well as the proposed item shall be formatted in such manner that a direct comparison can be readily made. ENGINEER

shall not be required to perform research to accomplish the comparison. It is the bidder's responsibility to submit complete descriptive and technical information for the ENGINEER and OWNER to perform a complete and proper appraisal.

If alternate manufacturers are accepted, the CONTRACTOR shall be responsible for any and all re-design or re-engineering required to accommodate alternate products. Change order proposals that add cost to the project as the result of redesign requirements for alternate manufacturers, or as the result of alternate manufacturers that do not meet the requirements of the construction documents, will not be accepted.

1.12 FINAL DESIGN PLANS

The intent of the Final Design Plans is that the CONTRACTOR shall furnish all labor, materials, tools, equipment, and transportation necessary for the proper execution of the Work in accordance with the Contract Documents and all incidental work necessary to complete the project in an acceptable manner, ready for use, occupancy or operation by the OWNER.

The CONTRACTOR shall keep one set of the Final Design Plans on the site of the work. This set shall be kept current by the addition of all reviewed changes, addenda and amendments thereto.

The Final Design Plans are intended to be explanatory to each other, but should any discrepancy appear or any misunderstanding arise as to the importance of anything contained in either, the CONTRACTOR shall obtain the necessary interpretation from the ENGINEER. Corrections of errors or omissions in the Final Design Plans may be made by the CONTRACTOR; when such corrections are necessary for the proper fulfillment of their intention. However, any changes or corrections to be performed after Notice to Proceed shall require the approval of both the ENGINEER and the CONTRACTOR.

All work or materials shown on the Plans and not mentioned in the Specifications, or any work specified and not shown on the Plans, shall be furnished, performed, and done by the CONTRACTOR as if same were both mentioned in the Specifications and shown on the Drawings.

1.13 SUBMITTAL/SHOP DRAWINGS

The CONTRACTOR shall submit shop and working drawings of concrete reinforcement, structural details, piping layout, wiring, materials and equipment fabricated especially for the Contract, and materials and equipment for which such drawings are specifically requested within these Contract Documents.

Such drawings shall show the principal dimensions, weight, structural and operating features, space required, clearances, type and/or brand of finish or shop coat, grease fittings, etc. depending on the subject of the drawing. When it is customary to do so, when the dimensions are of particular importance, or when so specified, the drawings shall be certified by the manufacturer or fabricator as correct for the Contract.

When so specified or if considered by the ENGINEER to be acceptable, manufacturer's specifications, catalog data, descriptive matter, illustrations, etc., may be submitted in place of shop and working drawings. In such case, the requirements shall be as specified for shop and working drawings, insofar as possible, except that the submission shall be per section 01300 of these Specifications.

No material or equipment shall be purchased or fabricated especially for the Contract until the required shop and working drawings have been submitted as herein above provided and reviewed for conformance to the Contract requirements by the ENGINEER. All such materials and equipment and the work involved in their installation or incorporation into the Work shall then be as shown in and represented by said drawings.

Until the necessary review has been made, the CONTRACTOR shall not proceed with any construction portion of the Work, the design or details of work, materials, equipment or other features for which review is required.

All shop and working drawings shall be prepared on standard size, 11-inch by 17-inch sheets except those, which are made by changing existing standard shop or working drawings. All drawings shall be clearly marked with the names of the Project Name, CONTRACTOR, and building, equipment, or structure to which the drawing applies, and shall be suitably numbered.

The review of shop and working drawings hereunder will be general only, and nothing contained in these general conditions shall relieve, diminish or alter in any respect the responsibilities of the CONTRACTOR under the Contract Documents and in particular, the specific responsibility of the CONTRACTOR for details and dimensions necessary for proper fitting and construction of the work as required by the Contract and for achieving the result and performance specified there under.

1.14 STANDARD SPECIFICATIONS

Where standard specifications, such as those of the American Society for Testing and Materials, the American National Standards Institute, the American Water Works Association, the American Association of State Highway and Transportation Officials, the Federal Aviation Agency, the Federal Specifications, etc. are referred to in the Specifications and Contract Documents and on the Drawings, said references shall be construed to mean the latest amended and/or revised versions of the said standard or tentative specification.

1.15 SPECIFIC BRANDS, MAKERS OR MANUFACTURERS

Wherever in the Specifications one or more specific brands, makers or manufacturers are set out and qualified by the "or equal" clause, it is intended to denote the quality standard of the article desired, but unless otherwise noted does not restrict the CONTRACTOR to the specific brand, make or manufacturer.

1.16 "OR EQUAL" CLAUSE

Whenever the words "or approved equal," or "or equal," or "similar to," etc., appear in the Specifications, they shall be interpreted to mean an item of material or equipment that, in the opinion of the ENGINEER is similar to that named, suited to the same use, capable of performing the same function as that named, has a record of service equal to that named, and is equal in quality, capacity and/or efficiency to that named.

1.17 SAFETY

The CONTRACTOR shall take all necessary precautions and provide all necessary safeguards to prevent personal injury and property damage. The CONTRACTOR shall provide protection for all persons including but not limited to his employees and employees of other contractors or subcontractors; members of the public; and employees, agents, and representatives of the OWNER, and regulatory agencies that may be on or about the Work. The CONTRACTOR shall provide protection for all public and private property including but not limited to structures, pipes, and utilities, above and below the ground.

The CONTRACTOR shall provide and maintain all necessary safety equipment such as fences, barriers, signs, lights, walkways, guards and fire prevention and fire-fighting equipment and shall take such other action as is required to fulfill his obligations under this subsection.

The CONTRACTOR shall comply with all federal, state and local laws, ordinances, rules and regulations and lawful orders of authorities having jurisdiction for the safety of persons and protection of property.

The CONTRACTOR shall designate a responsible member of his organization at the site whose duty shall be the prevention of accidents. This responsible person shall have the authority to take immediate action to correct unsafe or hazardous conditions and to enforce safety precautions and programs.

1.18 MATERIALS – SAMPLES – REVIEW

Unless otherwise expressly provided on the Drawings or in any of the other Contract Documents, only new materials and equipment shall be incorporated in the Work. All materials and equipment furnished by the CONTRACTOR to be incorporated in the Work shall be subject to the review of the ENGINEER. No material shall be processed or fabricated for the Work or delivered to the Work site without prior concurrence of the ENGINEER.

Facilities and labor for the storage, handling, and inspection of all materials and equipment shall be the responsibility of the CONTRACTOR. Defective materials and equipment shall be identified to the ENGINEER and removed immediately from the site of the Work.

If the ENGINEER so requires, either prior to or after commencement of the Work, the CONTRACTOR shall submit samples of materials for such special tests, as the ENGINEER deems necessary to demonstrate that they conform to the Specifications.

1.19 SANITARY FACILITIES

The CONTRACTOR shall provide adequate sanitary facilities for the use of those employed on the Work. Such facilities shall be made available when the first employees arrive on the site of the Work, shall be properly secluded from public observation, and shall be constructed and maintained during the progress of the Work in suitable numbers and at such points and in such manner as may be required.

The CONTRACTOR shall maintain the sanitary facilities in a satisfactory and sanitary condition at all times and shall enforce their use. He shall rigorously prohibit the committing of nuisances on the site of the Work, on the lands of the OWNER, or on adjacent property.

1.20 EMPLOYMENT QUALIFICATIONS

No person under the age of eighteen (18) years and no convict labor shall be employed to perform any work under this Contract. No person whose age or physical condition is such as to make his employment dangerous to his health or safety or to the health or safety of others shall be employed to perform any work under this Contract, provided that this shall not operate against the employment of physically handicapped persons, otherwise employable, where such persons may be safely assigned to work which they can ably perform. There shall be no discrimination because of race, creed, color, sex or political affiliation in the employment of persons for work under this Contract.

1.21 WORK ON "PRIVATE PROPERTY"

Private property is defined as property other than that belonging to the OWNER. Highway and railroad rights-of-way, public parks, school yards and other such properties shall be considered "private properties" for the purpose of this Paragraph.

In connection with water line, sewer line, gas line or similar work performed on "private property," the CONTRACTOR shall confine his equipment, the storage of materials and the operations of his workman to the limits indicated on the Drawings, or to lands and rights-of-way provided for the Project by the OWNER, and shall take every precaution to avoid damage to the buildings, grounds and facilities of the OWNER or private property.

Fences, walls, hedges, shrubs, etc., shall be carefully removed, preserved, and replaced when the construction is completed. Grassed areas, other than lawns, shall be graded, fertilized and seeded when construction is completed and in accordance with the requirements of the technical Specifications. Where ditches or excavations cross lawns, the sod shall be removed carefully and replaced when the backfilling has been completed. If sod is damaged or not handled properly, it shall be replaced with new sod equal to existing sod at the CONTRACTOR's expense. When construction is completed, the facilities and grounds of the OWNER's property shall be restored to as good or better condition than found as quickly as possible at the CONTRACTOR's expense.

When directed by the OWNER, large trees or other facilities that cannot be preserved and replaced shall be removed by the CONTRACTOR. The OWNER will assume the responsibility for settling with the property OWNER for the loss of said trees or facilities. The CONTRACTOR shall be solely and entirely responsible for any damage to all other trees or facilities.

Foundations, adjacent to where an excavation is to be made below the bottom of the foundation, shall be supported by shoring, bracing or underpinning as long as the excavation shall remain open, or thereafter if required to insure the stability of the foundation and the CONTRACTOR shall be held strictly responsible for any damage to said foundations.

1.22 LANDS FOR WORK

The OWNER will provide the lands upon which the work under this Contract is to be done or the necessary easements over said lands to include sufficient space for the proper execution of the work, together with right of access to same. The OWNER will provide the CONTRACTOR with information, which delineates and describes the lands owned and rights-of-way acquired. The OWNER shall provide land required for storage of construction materials and for any temporary construction facilities for the storage of equipment. The CONTRACTOR will furnish his own power and water supply unless otherwise specifically set out herein or in the contract documents.

1.23 INTERFERENCE WITH AND PROTECTION OF STREETS

The CONTRACTOR shall not close or obstruct any portion of a street, road, or private way without obtaining permits therefore from the proper authorities. If any street, road or private way shall be rendered unsafe by the CONTRACTOR's operations, he shall make such repairs or provide such temporary ways or guards as shall be acceptable to the proper authorities.

Streets, roads, private ways, and walks not closed shall be maintained passable and safe by the CONTRACTOR, who shall assume and have full responsibility for the adequacy and safety of provisions made therefore.

The CONTRACTOR shall, at least twenty-four (24) hours in advance, notify the Police and Fire Departments in writing, if the closure of a street or road is necessary. He shall cooperate with the Police Department in the establishment of alternate routes and shall provide adequate detour signs, plainly marked and well lighted, in order to minimize confusion.

All excavated materials and equipment to be incorporated in the Work shall be placed so as not to injure any part of the Work or existing facilities and so that free access can be had at all times to all parts of the Work and to all public utility installations in the vicinity of the Work. Materials and equipment shall be kept neatly piled and compactly stored in such locations as will cause a minimum of inconvenience to public travel and adjoining OWNERs, tenants and occupants.

1.24 EXISTING UTILITIES

Special precautions shall be taken by the CONTRACTOR to avoid damage to existing overhead and underground utilities owned and operated by the OWNER or by public or private utility companies.

Before proceeding with the Work, the CONTRACTOR shall confer with all public or private companies, agencies or departments that own and operate utilities in the vicinity of the Construction Work. The purpose of the conference, or conferences, shall be to notify said companies, agencies or departments of the proposed construction schedule, verify the location of, and possible interference with, the existing utilities that are shown on the Drawings, arrange for necessary suspension of service, and make arrangements to locate and avoid interference with all utilities (including house and any building connections) that are not shown on the Drawings.

The CONTRACTOR shall locate all unknown metallic hazards, namely buried pipe, metals, etc., by using a pipe locator. The pipe locator shall immediately precede the trench ditching and all hazards located shall be marked in such a manner as to notify the machine operator of such hazard.

Where existing utilities or appurtenant structures, either underground or above-ground, are encountered, they shall not be displaced or molested unless necessary, and in such case shall be replaced in as good or better condition than found as quickly as possible. Relocation and/or replacement of all utilities and appurtenant structures to accommodate the construction work shall be at cost to the OWNER, unless such relocation and/or replacement is by statute or agreement the responsibility of the CONTRACTOR.

1.25 FINAL CLEAN-UP

The Work will not be considered as completed until all final clean up has been done by the CONTRACTOR.

- END OF SECTION -

SECTION 01010
SUMMARY OF WORK

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. The WORK to be performed under this Contract shall consist of furnishing parts, tools, equipment, materials, supplies and manufactured articles, and furnishing all labor, transportation and services, including fuel, power, water and essential communications, and performing all work or other operations required for the fulfillment of the Contract in strict accordance with the Contract Documents. The WORK shall require that all work, materials and services not expressly indicated or called for in the Contract Documents, which may be necessary for the complete and proper construction of the WORK in good faith shall be provided.

B. The WORK will conform to the Maricopa Association of Governments (MAG) standards as well as the City of Bisbee Municipal Code. The most stringent will govern.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. The WORK of this Contract comprises of installing photovoltaic modules and general electric work at the existing City of Bisbee San Jose Wastewater Treatment Plant. The modifications and improvements shall include, but are not limited to the following:

- All work on this project will be coordinated with the City's Engineer and WWTP Operational staff to ensure that the WWTP can continue to operate. Existing equipment shall not be taken out of service until all prerequisite work is installed and new equipment has arrived and is ready for installation. Contractor shall make all effort to minimize process downtime.
- Installation of a new 400 kW DC photovoltaic system including structural, mechanical, electrical and controls;
- Installation of area lighting and electrical work as shown within the Contract Documents
- APS coordination for the interconnection application agreement, etc.

B. The WORK includes obtaining any permits related or required by the Contract.

1.3 WORK BY OTHERS

A. Where two (2) or more Contracts are being performed at one time on the same Site or adjacent land in such manner that work under one (1) Contract may interfere with work under another, the sequence and order of the WORK in either or both Contracts to the agreement of both contracting entities shall be determined. When the Site of one (1) Contract is the necessary or convenient means of access for performance of work under another, the privilege of access or other reasonable privilege to the CONTRACTOR so desiring may be granted, to the extent, amount, and in manner and at a time that shall be determined. Conduct its operations to cause a minimum of interference with the work of such other contractors, and shall cooperate fully with such contractors to allow continued safe access to their respective portions of the Site, as required to perform work under their respective contracts.

B. Interference with Work on Utilities: Cooperate fully with all utility forces or forces of other public or private agencies engaged in the relocation, altering, or otherwise rearranging of any facilities, which interfere with the progress of the WORK, and shall schedule the WORK to minimize interference with said relocation, altering or other rearranging of facilities. Any delays, reduction in work efficiency or hardships incurred shall be identified and resolved to the satisfaction of both parties.

1.4 USE OF SITE

A. Use of the Site shall be limited to its construction operations, including on-site storage of materials, on-site fabrication facilities and field offices.

B. All or part of the existing Site may be utilized during the entire period of construction for the conduct of normal operations. Cooperate and coordinate to facilitate operations and to minimize interference with the operations at the same time. In any event, access to the site during the period of construction shall be allowed.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

- END OF SECTION -

SECTION 01025
MEASUREMENT AND PAYMENT

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. Furnish all necessary labor, machinery, tools, apparatus, equipment, materials, services and other necessary supplies and perform all work shown on the Drawings and/or described in the Specifications and Contract Documents at the Lump Sum Price.

1.2 PROGRESS AND PAYMENT SCHEDULES

A. Within 15 days after the date of formal execution of the Agreement, prepare and submit, for approval, a Construction Schedule, which depicts the plan for completing the Contract requirements.

B. Maintain a current Construction Schedule updated monthly at the Site available for inspection. The Schedule shall reflect all approved Change Orders and their impact to the Project Schedule.

1.3 CONDITIONS FOR PAYMENT

A. Make payments for acceptable work in place and materials properly stored on-site. The value of payment shall be as established on the approved Schedule of Values. Terms of payment shall be as stated in the Contract Agreement.

1.4 CLAIMS FOR EXTRA WORK (See also the Contract)

A. If any claims that instructions by the Owner or others involve extra cost, the Contractor shall give written notice of said claim within 15 days after the receipt of such instructions, and in any event before proceeding to execute the work, stating clearly and in detail the basis of his claim or claims. No such claim shall be valid unless so made.

B. If, on the basis, of the available evidence, the determination is made that an adjustment of the Contract Price or time is justifiable, the procedure shall then be as provided in the Contract.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

- END OF SECTION -

SECTION 01040
COORDINATION

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall coordinate the WORK of all crafts, trades and subcontractors engaged on the WORK and he shall have final responsibility in regards to the Schedule, workmanship and completeness of each and all parts of the WORK.

B. All crafts, trades and subcontractors shall be made to cooperate with each other and with others, as they may be involved in the installation of work, which adjoins, incorporates, precedes or follows the work of another. It shall be the CONTRACTOR's responsibility to point out areas of cooperation prior to execution of subcontractors Agreements and the assignment of the parts of the WORK. Each craft, trade and subcontractor shall be responsible to the CONTRACTOR, for furnishing embedded items, giving directions for doing all cutting and fitting, making all provisions for accommodating the WORK and for protecting, patching, repairing and cleaning as required to satisfactorily perform the WORK.

C. The CONTRACTOR shall be responsible for supervising all cutting, digging and other action of his subcontractors and workers. Where such action impairs the safety or function of any structure or component of the Project as determined by the ENGINEER, the CONTRACTOR shall make such repairs, alterations and additions as will bring said structure or component back to its original design condition at no additional cost to the OWNER.

D. The CONTRACTOR is expected to be familiar with the General Requirements and all Sections of the detailed Specifications for all other trades and to study all Drawings applicable to his WORK to the end that complete coordination between the trades will be affected. CONTRACTOR shall submit the Request for Information (RFI) to the ENGINEER if conflicts exist within the Contract Documents.

The CONTRACTOR shall review the RFI and submit, with comments, to the ENGINEER for review and response. The RFI request should include a requested response date. The ENGINEER will make every effort to meet that requested date. However, the ENGINEER will have 14 calendar days to review and respond back to the CONTRACTOR. If the natures of the RFI or circumstances surrounding the RFI are beyond the control of the ENGINEER, requiring the need of more than 14 calendar days, the ENGINEER will notify the CONTRACTOR within five business days of receipt that it will take longer than 14 calendar days. At that time, the CONTRACTOR and ENGINEER will establish an agreed upon response date.

Upon receipt of the RFI response, the CONTRACTOR shall distribute the RFI response as necessary. The CONTRACTOR will be required to keep and maintain a numbered log of the RFI's and responses. A copy of the log and detail of each RFI shall be submitted to the ENGINEER for Project closeout.

E. At the discretion of the ENGINEER, additional clarification information may be provided to the CONTRACTOR, regarding the Contract Documents. This notification shall be submitted on an Engineering Supplemental Information (ESI) form. It is the intent of the ESI to provide additional clarification information to the Contract Documents. It is the intent of the ENGINEER to transmit the ESI's in a timely manner. However, the ENGINEER shall not be held responsible for rework to work performed prior to issuance of the ESI.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION

SECTION 01045
CUTTING AND PATCHING

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. Perform all WORK associated with cutting and patching for connection to existing service lines. This shall be complete and operable, in accordance with the Contract Documents.

B. Do not cut and patch in a manner that would result in a failure of the WORK to perform as intended, decreased energy performance, increased maintenance, decreased-operational life or decreased safety.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Match existing materials for cutting and patching work with new materials conforming to Project Requirements.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Inspect conditions prior to WORK to identify scope and type of WORK required. Protect adjacent WORK. Notify CONTRACTOR and OWNER of WORK requiring interruption to building services or OWNER's operations.

B. Perform WORK with Workmen skilled in the trades involved.

C. **Cutting:** Use cutting tools, not chopping tools. Make neat holes. Minimize damage to adjacent work. Check for concealed utilities and structure before cutting.

D. **Patching:** Make patches, seams and joints durable and inconspicuous. Comply with tolerances for new WORK.

E. Clean WORK area and areas affected by cutting and patching operations.

- END OF SECTION -

SECTION 01060
REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL

A. Throughout the Contract Documents, reference is made to Codes and Standards which establish qualities and types of workmanship and materials and which establish methods for testing and reporting on the pertinent characteristics.

B. Work Included: Where materials or workmanship are required by these Contract Documents to meet or exceed the specifically named Code or Standard, it is the Contractor's responsibility to provide materials and workmanship which meet or exceed the specifically named Code or Standard.

C. Related Work: Specific naming of the Codes or Standards occurs on the Drawings and in other Sections of these Specifications.

D. Quality Control: It is the Contractor's responsibility to verify the requirements of the specifically named Codes and Standards to verify that the items produced for this work meet or exceed the specified requirements.

E. The Engineer reserves the right to reject items incorporated into the work which fail to meet the specified minimum requirements or accept non-complying items subject to an adjustment in the Contract amount approved by the Engineer and the Owner.

F. Governing authorities have been contacted where necessary to obtain information needed for the preparation of Contract Documents. It is the Intention of the Contract Documents to comply with all applicable laws, statues, building codes, and regulations.

G. Codes referenced for the preparation of these Contract Documents include, but are not necessarily limited to:

1. International Building Code, 2006
2. Life Safety Code, NFPA 101, current edition
3. International Plumbing Code, 2006
4. International Mechanical Code, 2006
5. International Fire Code, 2006
6. International Energy Conservation Code, 2006
7. National Electrical Code, 2008
8. National Fire Protection Codes, latest adopted edition
9. ANSI A117.1, 2003 (Accessible Buildings)
10. Arizona State Law (Designing for the Physically Disabled)
11. The Americans with Disabilities Act of 1990

-END OF SECTION-

SECTION 01070
ABBREVIATIONS OF INSTITUTIONS

PART 1 – GENERAL

1.1 GENERAL

A. Wherever in these Specifications, references are made to the Standards, Specifications or other Published Data of the various International, National, Regional or Local Organizations, such organizations may be referred to by their acronym or abbreviation only. As a guide, to the User of these Specifications the following acronyms or abbreviations, which may appear in these Specifications, shall have the meanings indicated herein.

1.2 ABBREVIATIONS

AA	Aluminum Association
AAMA	Architectural Aluminum Manufacturer's Association
AAR	Association of American Railroads
AASHTO	American Association of State Highway and Transportation Officials
AATCC	American Association of Textile Chemists and Colorists
ACI	American Concrete Institute
AFBMA	Anti-Friction Bearing Manufacturer's Association, Inc.
AFPA	American Forest Products Association
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
AHA	American Hardboard Association
AHAM	Association of Home Appliance Manufacturers
AI	The Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Moving and Conditioning Association
ANS	American Nuclear Society
ANSI	American National Standards Institute, Inc.
APA	American Plywood Association or American Parquet Association, Inc.
API	American Petroleum Institute
APWA	American Public Works Association
ARI	Air-Conditioning and Refrigeration Institute
ASA	Acoustical Society of America
ASAE	American Society of Agricultural Engineers
ASCE	American Society of Civil Engineers

ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ASLE	American Society of Lubricating Engineers
ASME	American Society of Mechanical Engineers
ASNT	American Society of Nondestructive Testing
ASQC	American Society for Quality Control
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials
AWCI	American Wire Cloth Institute
AWPA	American Wood Preservers Association
AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWWA	American Water Works Association
BBC	Basic Building Code, Building Officials and Code Administrators International
BHMA	Builders Hardware Manufacturer's Association
CABO	Council of American Building Officials
CBM	Certified Ballast Manufacturers
CDA	Copper Development Association
CEMA	Conveyors Equipment Manufacturer's Association
CGA	Compressed Gas Association
CLFMI	Chain Link Fence Manufacturer's Institute
CMA	Concrete Masonry Association
CRSI	Concrete Reinforcing Steel Institute
DCDMA	Diamond Core Drill Manufacturer's Association
DHI	Door and Hardware Institute
DIPRA	Ductile Iron Pipe Research Association
EIA	Electronic Industries Association
ETL	Electrical Test Laboratories
EPA	Environmental Protection Agency
FCC	Federal Communications Commission
FCI	Fluid Controls Institute
FM	Factory Mutual System
FPL	Forest Products Laboratory
HI	Hydronics Institute
HPMA	Hardwood Plywood Manufacturers Association
IAPMO	International Association of Plumbing and Mechanical Officials
ICBO	International Conference of Building Officials

IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society
IME	Institute of Makers of Explosives
IP	Institute of Petroleum (London)
IPC	Institute of Printed Circuits
IPCEA	Insulated Power Cable Engineers Association
ISDSI	Insulated Steel Door Systems Institute
ISA	Instrument Society of America
ISEA	Industrial Safety Equipment Association
ISO	International Organization for Standardization
ITE	Institute of Traffic Engineers
MBMA	Metal Building Manufacturer's Association
MIL	Military Standards (DoD)
MPTA	Mechanical Power Transmission Association
MSS	Manufacturers Standardization Society
MTI	Marine Testing Institute
NAAMM	National Association of Architectural Metal Manufacturer's
NACE	National Association of Corrosion Engineers
NAGDM	National Association of Garage Door Manufacturers
NB	National Board of Boiler and Pressure Vessel Inspectors (alternate NBBPVI)
NBS	National Bureau of Standards (Now NIST)
NCCLS	National Committee for Clinical Laboratory Standards
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NETA	International Electrical Testing Association
NFPA	National Fire Protection Association or National Fluid Power Association or National Forest Products Association
NISO	National Information Standards Organization
NLGI	National Lubricating Grease Institute
NMA	National Microfilm Association
NRCA	National Roofing Contractors Association
NSF	National Sanitation Foundation
NWMA	National Woodwork Manufacturers Association
NWWDA	National Wood Window and Door Association
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
PPI	Plastics Pipe Institute

RCRA	Resource Conservation and Recovery Act
RIS	Redwood Inspection Service
RMA	Rubber Manufacturers Association
RVIA	Recreational Vehicle Industry Association
RWMA	Resistance Welder Manufacturer's Association
SAE	Society of Automotive Engineers
SAMA	Scientific Apparatus Makers Association
SDI	Steel Door Institute
SMA	Screen Manufacturers Association
SMACCNA	Sheet Metal and Air Conditioning Contractors National Association
SPI	Society of the Plastics Industry, Inc.
SPIB	Southern Pine Inspection Bureau
SPR	Simplified Practice Recommendation
SSA	Swedish Standards Association
SSBC	Southern Standard Building Code, Southern Building Code Congress
SSPC	Society for Protective Coating
SSPWC	Standard Specifications for Public Works Construction
TAPPI	Technical Association of the Pulp and Paper Industry
TFI	The Fertilizer Institute
TIA	Telecommunications Industries Association
TPI	Truss Plate Institute
UBC	Uniform Building Code
UL	Underwriters Laboratories, Inc.
WCLIB	West Coast Lumber Inspection Bureau
WCRSI	Western Concrete Reinforcing Steel Institute
WEF	Water Environment Federation
WIC	Woodwork Institute of California
WRI	Wire Reinforcement Institute, Inc.
WPA	Western Wood Products Association

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

- END OF SECTION -

SECTION 01090
REFERENCE STANDARDS

PART 1 – GENERAL

1.1 GENERAL

A. **Titles of Sections and Paragraphs:** Titles and Subtitles accompanying Specification Sections and paragraphs are for convenience and Reference only and do not form a part of the Specifications.

B. **Applicable Publications:** Whenever in these Specifications References are made to Published Specifications, Codes, Standards or other Requirements, it shall be understood that wherever no date is specified, only the latest Specifications, Standards or Requirements of the respective issuing agencies, which have been published as of the date that the Contract shall apply; except to the extent that said Standards or Requirements may be in conflict with applicable Laws, Ordinances or Governing Codes. No Requirements set forth in the Specifications or shown on the Drawings will be waived because of any provision of, or omission from, said Standards or Requirements.

C. **Specialists, Assignments:** In certain instances, Specification text requires (or implies) that specific WORK is to be assigned to specialists or expert entities, who must be engaged for the performance of that WORK. Such assignments shall be recognized as Special Requirements. These Requirements shall not be interpreted so as to conflict with the enforcement of Building Codes and similar Regulations Governing the WORK; also, they are not intended to interfere with Local Union Jurisdiction Settlements and similar conventions. Such assignments are intended to establish which party or entity involved in a specific unit of work is recognized as "Expert" for the indicated construction processes or operations. Nevertheless, the final responsibility for fulfillment of the entire set of Contract Requirements remains.

1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Construct the WORK in accordance with the Contract Documents and the referenced portions of those Referenced Codes, Standards and Specifications.

B. **Verify the following references agree with the plans and local requirements** - References herein to "Building Code" shall mean International Building Code (IBC) 2006. Similarly, references to "Mechanical Code" or "International Mechanical Code," "Plumbing Code" or "Uniform Plumbing Code," "Fire Code" or "International Fire Code," shall mean International Mechanical Code (IMC) 2003, Uniform Plumbing Code (UPC) 1994 and International Fire Code (IFC) 2006. "Electric Code" or "National Electric Code (NEC)" shall mean the National Electric Code of the National Fire Protection Association (NFPA) 2003. The latest edition of the codes as approved by the Municipal Code and used by the local agency as of the date that the WORK is advertised for bids, as adopted by the agency having jurisdiction, shall apply to the WORK herein, including all Addenda, Modifications, Amendments, or other Lawful changes thereto.

C. In case of conflict between Codes, Reference Standards, Drawings and the other Contract Documents, the most stringent Requirements shall govern. All conflicts shall be brought to the attention of the ENGINEER for clarification and directions prior to ordering or providing any materials or furnishing labor through the RFI process. The most stringent Requirements may be bid on.

D. References herein to "OSHA Regulations for Construction" shall mean **Title 29, Part 1926, Construction Safety and Health Regulations,** Code of Federal Regulations (OSHA), including all changes and amendments thereto.

E. References herein to "OSHA Standards" shall mean **Title 29, Part 1910, Occupational Safety and Health**

Standards (OSHA), Code of Federal Regulations, including all changes and Amendments thereto.

F. **Applicable Standard Specifications:** References in the Contract Documents to "Standard Specifications" or SSPWC shall mean the Standard Specifications for Public Works Construction.

1.3 REGULATIONS RELATED TO HAZARDOUS MATERIALS

A. Responsibility for all work included in the Contract Documents, regardless if shown or not, shall comply with all EPA, OSHA, RCRA, NFPA, and any other Federal, State, and Local Regulations governing the storage and conveyance of hazardous materials, including petroleum products.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

- END OF SECTION -

SECTION 01292
SCHEDULE OF VALUES

PART 1 – GENERAL

1.1 SUMMARY

A. **Section Includes:** Requirements for preparation, format, and submittal of Schedule of Values.

1.2 PREPARATION

A. Prepare Schedule of Values identifying costs of Major Items of Work and other costs shown in sample included at end of this Section.

B. Divide the Work into following Major Items of Work and subdivide the Major Items that will complement not only the scope of the work, but the progress of work as well.

C. Assign prices to Items of Work which aggregate the Contract Price. Base prices on costs associated with scheduled activities based on the Project Schedule for each Item of Work.

1.3 SUBMITTALS

A. Submit preliminary schedule of values in accordance with Section 01025 and 00700.

B. Submit corrected schedule of values within 10 days upon receipt of reviewed Schedule of Values, but no later than 10 days prior to anticipated submittal of first Application for Payment, in accordance with Section 01025.

C. Upon request, support prices with data which will substantiate their correctness.

D. If activities are added or removed from the Progress Schedule revise the Schedule of Values and resubmit.

1.4 SAMPLE SCHEDULE OF VALUES

A. Following is an acceptable form for Schedule of Values.

SCHEDULE OF VALUES		
NO.	DESCRIPTION OF ITEM	LUMP SUM COST
1.	Mobilization.	
2.	General earthwork	
4.	General electrical work not included on Major Items of Work.	
5.	Major Items of Work (for example, panel array, inverter and mounting etc.)	
6.	Start-up and demobilization	
7.	Miscellaneous work items and other prices not included in previous items and necessary to complete the Work.	
	TOTAL LUMP SUM BID	

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

-END OF SECTION-

SECTION 01294
APPLICATIONS FOR PAYMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Procedures for preparation and submittal of Applications for Payment.

B. **Related Sections:**

1. Section 01292 - Schedule of Values.
2. Section 01310 - Progress Schedules and Reports.

1.2 FORMAT

A. Develop satisfactory spreadsheet-type form generated by downloading cost data from the Progress Schedule.

B. Fill in information required on form.

C. When Change Orders are executed, add Change Orders at end of listing of scheduled activities.

1. Identify change order by number and description.
2. Provide cost of change order in appropriate column.

D. After completing, submit Application for Payment.

E. The ENGINEER will review application for accuracy. When accurate, the ENGINEER will transmit application to OWNER for processing of payment.

F. Execute application with signature of responsible officer of CONTRACTOR.

1.3 SUBSTANTIATING DATA

A. **Provide Substantiating Data with cover letter identifying:**

1. Project.
2. Application number and date.
3. Detailed list of enclosures.
4. For stored products with item number and identification on application, description of specific material, and proof of insurance coverage for offsite stored products and copies of invoices.

1.4 SUBMITTALS

A. Submit five copies of Application for Payment and Substantiating Data with cover letter to Owner or Engineer.

B. Coordinate requirements with the Contract General Conditions.

1.5 PAYMENT REQUESTS

A. Prepare progress payment requests on a monthly basis. Base requests on the breakdowns of costs for each scheduled activity and the percentage of completion for each activity.

B. Indicate total dollar amount of work planned for every month of the project. Equate sum of monthly amounts to Lump Sum Contract Price.

C. Generate Progress Payment request forms by downloading cost data from the schedule information to a spreadsheet type format. Identify each activity on the Progress Schedule that has a cost associated with it, the cost for each activity, the estimated percent complete for each activity, and the value of work completed for both the payment period and job to date.

D. Prepare summary of cost information for each Major Item of Work listed in the Schedule of Values. Identify the value of work completed for both the payment period and job to date.

E. Submit progress payment requests at progress meetings.

PART 2 – PRODUCTS - (Not Used)

PART 3 – EXECUTION – (Not Used)

-END OF SECTION-

SECTION 01300
SUBMITTALS

PART 1 – GENERAL

1.1 WORK INCLUDED

A. Shop Drawing, Descriptive Literature, Project Data and Samples (specifically, when Samples are requested) for all manufactured or fabricated items shall be Submitted by the CONTRACTOR. CONTRACTOR shall examine and review the Submittal to ensure that the information is in the form and in the manner required by the ENGINEER. The review of the Submittal by the ENGINEER shall not be construed as a complete check or approval, but will only indicate that the general method of construction and detailing is satisfactory. Review of such Submittal will not relieve the CONTRACTOR of the responsibility for any errors, which may exist. The CONTRACTOR shall be responsible for the dimensions and design of adequate connections, details and satisfactory of all WORK.

1.2 DEFINITIONS

A. The term "Submittals" shall mean shop drawings, manufacturer's drawings, catalog sheets, brochures, descriptive literature, diagrams, schedules, calculations, material lists, performance charts, test reports, office and field samples and items of similar nature, which are normally Submitted for the ENGINEER's review for conformance with the Design Concept and compliance with the Contract Documents.

1.3 GENERAL CONDITIONS

A. Review by the ENGINEER of shop drawings or submittals of material and equipment shall not relieve the CONTRACTOR from the responsibilities of furnishing proper dimension, size, quantity, materials and all performance characteristics to, efficiently perform the Requirements and intent of the Contract Documents. Review shall not relieve the CONTRACTOR 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. Review of shop drawings shall not be construed as releasing the CONTRACTOR from the responsibility of complying with the Contract Documents.

B. Do not consider Submittals as Contract Documents. Purpose of Submittals is to demonstrate how CONTRACTOR intends to conform to the design concepts.

1.4 GENERAL REQUIREMENTS FOR SUBMITTALS

A. Shop drawings shall be prepared by a qualified detailer. Details shall be identified by reference to sheet and detail numbers shown on Contract Documents. Where applicable, show fabrication, layout, setting and erection details. Shop drawings are defined as original drawings prepared by the CONTRACTOR, subcontractor, suppliers or distributors performing WORK under this Contract. Shop drawings illustrate some portion of the WORK and show fabrication, layout, setting or erection details of equipment, materials and components. Shop drawings shall be folded to an approximate size of 8½-inch x 11-inch and in such manner that the title block will be located in the lower right-hand corner of the exposed surface.

B. Project data shall include manufacturer's standard schematic drawings modified to delete information, which is not applicable to the Project and shall be supplemented to provide additional information applicable to the Project. Each copy of descriptive literature shall be clearly marked to identify pertinent information as it applies to the Project.

C. Where samples are required, they shall be adequate to illustrate materials, equipment or workmanship and to establish Standards by which completed WORK is judged. Provide sufficient size and quantity to clearly

illustrate functional characteristics of product and material, with integrally related parts and attachment devices, along with a full range of color samples.

D. The CONTRACTOR shall review and check Submittals, indicating his review by initials and date.

E. If the Submittals deviate from the Contract Drawings and/or Specifications, the CONTRACTOR shall clearly identify the deviation and state any reasons for the deviation. The ENGINEER may approve a change. Any costs resulting from a change will be the responsibility of the CONTRACTOR.

F. Additional information on particular items, such as special drawings, schedules, calculations, performance curves and material details, shall be provided when specifically requested by the Technical Specifications.

G. Submittals for all electrically operated items (including instrumentation and controls) shall include complete wiring diagrams showing lead, runs, number of wires, wire size, color coding, all terminations and connections and coordination with related equipment.

H. Equipment shop drawings shall indicate all factory or shop paint coatings applied by suppliers, manufacturers and fabricators; the CONTRACTOR shall be responsible for insuring the compatibility of such coatings with the field applied paint products and systems.

I. Fastener Specifications of manufacturer shall be indicated on equipment shop drawings.

J. No material shall be fabricated or shipped unless the applicable drawings or Submittals have been reviewed and approved by the CONTRACTOR and ENGINEER.

K. All bulletins, brochures, instructions, parts lists and warranties packaged with and accompanying materials and products delivered to and installed in the Project shall be saved and transmitted to the ENGINEER for safe keeping and preparations of the Operation &Maintenance Manuals.

L. One electronic copy of the Submittals (in pdf format) shall be provided by the CONTRACTOR to the ENGINEER.

1.5 SUBCONTRACTOR or VENDOR RESPONSIBILITIES

A. Verify field measurements, field construction criteria, catalog numbers and similar data.

B. Coordinate each Submittal with requirements of Work and Contract Documents.

C. Submit two (2) hard copies and one electronic copy (in pdf format), excluding samples or mark-ups, of the shop drawings to the CONTRACTOR for review and submission to the ENGINEER for review. Number of hard copies to the CONTRACTOR can be modified with CONTRACTOR'S approval.

1.6 CONTRACTOR RESPONSIBILITIES

A. Submit complete listing of all required shop drawing submittals by Specification Section to the ENGINEER.

B. Submit shop drawings, product data, samples and other pertinent information in sufficient detail to show compliance with specified requirements.

C. Check, verify and revise Submittals as necessary to bring them into conformance with Contract Documents and actual field conditions.

1. Determine and verify quantities, dimensions, specified design and performance criteria, materials, catalog numbers and similar data.

2. Coordinate Submittal with other Submittals and with the requirements of the Contract Documents.

3. Include a copy of the specific Specification Section with checkmarks to indicate conformance and "X's" to indicate deviation or non-conformance of each subsection. Explanation of non-conformance or deviation will need to be attached, along with proposed change as required.

D. After completion of checking, verification and revising, stamp, sign and date Submittals indicating review and approval and submit to ENGINEER.

1. Stamp and signature indicates CONTRACTOR has satisfied shop drawing review responsibilities and constitutes written review of shop drawing with general conformance with the Contract Documents.
2. Shop drawings without CONTRACTOR written reviewed stamp and signature will be returned for resubmission.

E. **Shop Drawings:** Submit one electronic copy (in pdf format) to the ENGINEER. One (1) electronic copy will be returned with reviewer's comment's.

F. **Product Data and Manufacture's Instructions:** Submit one electronic copy (pdf format). Excise or cross out non-applicable information and clearly mark applicable information with citations to and terminology consistent with Contract Documents.

1. One (1) electronic copy will be returned with reviewer's comments and stamp.

G. **Samples:** Submit two (2) samples labeled with reference to applicable Contract Documents. Label will be returned with reviewer's selection when appropriate, comments and stamp. Samples will not be returned unless return is requested in writing and additional samples are submitted.

H. Assume risk expense and delays when proceeding with work related to required Submittals without review and acceptance.

I. **Submittals in AutoCAD and PDF Format:** Product Equipment Submittal shall also include the following:

3. Equipment Shop Drawings & Diagrams: Submit electronic AutoCAD (2008, or later) drawings of the actual process equipment to be installed for use by the ENGINEER.
4. Contractor using other software shall be required to provide to the ENGINEER conclusive evidence of 100% data transfer compatibility.

K. **Deferred Submittals:** Submit any and all requested deferred submittals as required by the Building Permit or local governing agency.

1.7 ENGINEER'S RESPONSIBILITY

A. ENGINEER's review of shop drawings, samples or test procedures will be only for conformance with design concepts and for compliance with information given in Contract Documents.

1. ENGINEER's review does not extend to:

a. Accuracy of dimensions, quantities or performance of equipment and systems designed by CONTRACTOR, subcontractor or Vendor.
b. CONTRACTOR or subcontractor means, methods, techniques, sequences or procedures, except when specified, indicated on the Drawings or required by Contract Documents.
c. Safety precautions or programs related to safety, which shall remain the sole responsibility of the CONTRACTOR and the subcontractor.

B. Except as may be provided in subsequent Specification, a submittal will be returned within 14 days. When a Submittal cannot be returned within that period, ENGINEER will, within a reasonable time after receipt of the Submittals, give notice of the date by which that submittal will be returned.

C. For Submittals returned No Exceptions Taken – Amended Submittal is not required.

D. For Submittals returned Submit Specific Item – Make Correction Noted/See all Comments, CONTRACTOR shall incorporate all review comments into the work, and supply items listed in the Submittal review for additional review.

E. For Submittals returned Accepted with Corrections Noted – Make Correction Noted/See all Comments, CONTRACTOR shall incorporate all review comments into the work, and supply items listed in the amended Submittal for review.

D. For Submittals returned Revise and Resubmit – Make Corrections Note/See All Comments, CONTRACTOR shall incorporate the review comments into a complete revised package and resubmit it for review.

E. For Submittals returned Rejected – See All Comments, CONTRACTOR shall develop a new Submittal package with materials, equipment, methods, etc. that meet the requirements of the Contract Documents.

F. For Submittals returned Submittal Not Reviewed, Filed for Record, no further action is required by the CONTRACTOR for this Submittal.

G. ENGINEER will be entitled to rely upon the accuracy or completeness of designs, calculations or certification made by licensed professionals accompanying a particular Submittal whether or not a stamp or seal is required by Contract Documents or Laws and Regulations.

H. Costs incurred by the ENGINEER, as a result, of additional reviews of a particular Submittal after the second time it has been reviewed shall be borne by CONTRACTOR. Reimbursement to ENGINEER will be made by issuance of a Change Order.

1.8 MINOR OR INCIDENTAL PRODUCTS AND EQUIPMENT SCHEDULES

A. Shop Drawings of minor or incidental fabricated products will not be required, unless requested.

B. Submit tabulated lists of minor or incidental products showing the names of the manufactures and catalog numbers, with Product Data and Samples, as required to, determine acceptability.

1.9 SUBMITTALS FOR INFORMATION OR RECORD ONLY

A. Submit one electronic copy of each. None will be returned.

B. **Mill Test Reports:**

1. Submit three (3) certified copies of factory and mill test reports for record only and one (1) electronic copy. No copies will be returned.
2. Do not incorporate Products in the work, which have not passed testing and inspection satisfactorily.
3. Pay for mill and factory tests.

C. **Reinforcing Steel:**

1. Submit reinforcing steel fabrication and setting drawings for information or record only. No copies will be returned.

2. Note deviations and variations as specified for shop drawings.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

- END OF SECTION -

SECTION 01310
PROGRESS SCHEDULES AND REPORTS

PART 1 – GENERAL

1.1 SUMMARY

A. **Section Includes:** Preparation, submittal and maintenance of computerized progress schedule and reports, contract time adjustments and payment requests, including the following:

1. Preliminary Schedule
2. Baseline Schedule
3. Weekly Schedule
4. Schedule Updates
5. Schedule Revisions
6. Time Impact Analyses
7. Final Schedule Submittal

B. **Related Sections:**

1. Section 01300 - Submittals
2. Section 01312 - Project Meetings
3. Section 01700 – Project Closeout

C. OWNER reserves the right to disapprove scheduler when submitted by CONTRACTOR if not qualified. OWNER reserves the right to remove scheduler from the project if found to be incompetent.

1.2 PRECONSTRUCTION SCHEDULING MEETING

A. The OWNER/ENGINEER will conduct a Preconstruction Schedule Meeting within 14 Calendar days after Notice to Proceed. This meeting may be separate from the Preconstruction Conference Meeting and would cover schedule issues exclusively.

B. At the meeting, scheduling requirements shall be reviewed with CONTRACTOR. These include schedule preparation, reporting requirements, updates, revisions and schedule delay analysis. CONTRACTOR shall present their schedule methodology, planned sequence of operations and present their proposed activity coding structure.

C. **Coding Structure:** CONTRACTOR shall submit proposed coding structure, identifying the code fields and the associated code values it intends to use in the project schedule. The coding structure shall, include at a minimum, code fields for Project Segment or Phase, Area of Work, Type of Work, Submittal/Procurement/Construction and Responsibility/Subcontractor.

1.3 PREPARATION

A. Preparation and submittal of Progress Schedule represents CONTRACTORS intention to execute the WORK within specified time and constraints.

B During preparation of the preliminary Progress Schedule, the CONTRACTOR shall utilize the Construction Phasing Plan as provided in Appendix C of the Specifications. If necessary, the ENGINEER will facilitate CONTRACTOR efforts by being available to answer questions regarding sequencing issues, scheduling constraints, interface points and dependency relationships as defined with in the Construction Phasing Plan in Appendix C of the Specifications.

C. Failure to include an activity required for execution of the Work does not excuse CONTRACTOR from completing the WORK and portions thereof within specified times and at price specified in Agreement. Failure of CONTRACTOR to include required schedule constraints, sequences or milestones in schedule shall not relieve CONTRACTOR of obligation to conform to requirements of Contract. Acceptance of schedule shall not waive Contract requirements. In event of conflict between accepted schedule and Contract requirements, terms of Contract shall govern at all times, unless requirements are waived in writing by the OWNER.

D. Reference Schedule to calendar days with beginning of Contract Time as Day "1."

E. Should CONTRACTOR submit a Baseline Schedule showing project completion more than 20 working days prior to Contract completion date OWNER may issue Change Order, at no cost to OWNER, revising time of performance of WORK and Contract completion date to match CONTRACTORS schedule completion date. Contract milestone dates, if any, shall be adjusted accordingly.

F. **Schedule Logic:** Schedule shall be assembled to show order in which CONTRACTOR proposes to carry out WORK, indicate restrictions of access, availability of Work areas, and availability and use of manpower, materials and equipment. Following criteria shall form basis for assembly of schedule logic.

1. Which activities must be completed before subsequent activities can be started?
2. Which activities can be performed concurrently?
3. Which activities must be started immediately following completed activities?
4. What major facility, equipment or manpower restrictions are required for sequencing these activities?

1.4 SUBMITTAL OF PROGRESS SCHEDULES

A. Submit preliminary

B. Submit, on a monthly basis, updated schedules as specified. Submit final schedule update as specified.

C. Submit revised schedules and time impact analyses as specified.

1.5 NETWORK DETAILS AND GRAPHICAL OUTPUT

A. Produce a clear, legible and accurate calendar based, time scaled, graphical network diagram. Group activities related to the same physical areas of the WORK. Produce the network diagram based upon the early start of all activities.

B. Include for each activity, the description, activity number, estimated duration in calendar days, total float and all activity relationship lines.

C. Illustrate order and interdependence of activities and sequence in which WORK is planned to be accomplished. Incorporate the basic concept of the precedence diagram network method to show how the start of one activity is dependent upon the start or completion of preceding activities and its completion restrict the start of following activities.

D. Indicate the critical path for the project.

E. Identify system shutdown dates, system tie-in dates, specified interim completion or milestone dates and contract completion date as milestones.

F. **Include, in addition to Construction Activities:**

1 Submission dates and review periods for major equipment submittals

3. Equipment and long-lead material deliveries over eight (8) weeks.
4. Approvals required by regulatory agencies or other third parties.

1.6 SCHEDULE OF SHOP DRAWING AND SAMPLE SUBMITTALS

A. After the Schedule has been submitted and accepted by OWNER, CONTRACTOR shall print out, submit list of all shop drawings and sample submittals for all WORK using early start dates. This listing will contain all submittals required for the entire WORK including those listed above.

1.7 UPDATING THE SCHEDULE

A. Update the schedule on a monthly basis, using the first of each month as a data date.

B. Should monthly Schedule Update show project completion later than current Contract completion date, CONTRACTOR shall prepare and submit a plan to show how the project will get back on schedule.

1.8 REVISIONS TO SCHEDULE

A. **Submit revised schedule within five (5) calendar days:**

1. When delay in completion of any activity or group of activities indicates an overrun of the Contract time or milestone dates by 20 working days or 5% of the remaining duration, whichever is less.
2. When delays in submittals, deliveries or work stoppages are encountered making necessary the replanning or rescheduling of activities.
3. When the schedule does not represent the actual progress of activities.
4. When any change to the sequence of activities, the completion date for major Portions of the work or when changes occur which affect the critical path.
5. When Contract modification necessitates schedule revision, submit schedule analysis of change order work with cost proposal.

B. Submit revised schedule and materials as specified under Article, "Submittal of Progress Schedule."

C. Make revisions on most recently accepted version of schedule.

D. Schedule Revisions shall not be prepared or submitted with Schedule Updates. They shall be separate submittals and shall be noted as Schedule Revisions.

E. Only upon acceptance of a revision by the OWNER shall it be reflected in the next monthly Schedule Update.

F. Schedule Revisions submitted for the purpose of mitigating a CONTRACTOR caused project delay (Recovery Schedule) shall not be implemented until the OWNER reviews and accepts the Schedule Revision.

1.9 ADJUSTMENT OF CONTRACT TIMES

A. If the CONTRACTOR believes that the OWNER has impacted its work, such that the project completion date will be delayed, the CONTRACTOR must submit proof demonstrating the delay to the critical path. This proof, in the form of a Time Impact Analysis, may entitle the CONTRACTOR to an adjustment of contract time.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

SECTION 01312
PROJECT MEETINGS

PART - 1 GENERAL

1.1 SUMMARY

A. **Section Includes:** Requirements for conducting conferences and meetings for the purposes of addressing issues related to the Work, reviewing and coordinating progress of the Work and other matters of common interest, and includes the following:

1. Qualifications of Meeting Participants.
2. Preconstruction Conference Progress Meetings.
3. Pre-installation Meetings.
4. Weekly Meetings
5. Post Construction Meeting.

B. **Related Sections:**

1. Section 01310 – Progress Schedules and Reports
2. Section 01740 – Construction Progress Photos

1.2 QUALIFICATIONS OF MEETING PARTICIPANTS

A. Representatives of entities participating in meetings shall be qualified and authorized to act on behalf of entity each represents.

1.3 PRECONSTRUCTION CONFERENCE

A. Upon issuance of Notice to Proceed, or earlier when mutually agreeable, the OWNER/ENGINEER will arrange a preconstruction conference in convenient place for most persons invited.

B. Attending Preconstruction Conference: CONTRACTOR superintendent, OWNER, ENGINEER, representatives of utilities, major subcontractors and others involved in performance of the Work, and others necessary to agenda.

C. OWNER/ENGINEER will preside at conference.

D. **Purpose of Conference:** To establish working understanding between parties and to discuss Construction Schedule, shop drawing and other submittals, cost breakdown of major lump sum items, processing of submittals and applications for payment, and other subjects pertinent to execution of the Work.

E. **Agenda Will Include:**

1. Adequacy of distribution of Contract Documents.
2. Distribution and discussion of list of major subcontractors and suppliers.
3. Proposed progress schedules and critical construction sequencing.
4. Major equipment deliveries and priorities.
5. Project coordination.
6. Designation of responsible personnel.
7. Procedures and Processing of:

a. Field decisions.
b. Proposal requests.
c. Submittals.
d. Change Orders.
e. Applications for Payment.
f. Record Documents.

8. Use of Premises:

a. Office, construction, and storage areas.
b. OWNER's requirements.

9. Construction facilities, controls, and construction aids.
10. Owner's Geotechnical Evaluation/Soils Report
11. Temporary utilities.
12. Safety and first aid procedures.
13. Security procedures.
14. Housekeeping procedures.
15. Storm Water Pollution Prevention Plan and Dust control

F. The CONTRACTOR will record minutes of meeting and distribute copies of minutes within 7 days of meeting to participants and interested parties.

1.5 PROGRESS MEETINGS

A. **Weekly Progress Meetings:**

1. Conduct progress meetings at least once every week in CONTRACTOR'S field office.
2. Require attendance of all subcontractors who are or are proximate to be actively involved in the Work, or who are necessary to agenda.
3. Invite OWNER, ENGINEER, and utility Companies when the Work affects their interests, and others necessary to agenda. CONTRACTOR shall set up multiple-party audio conferencing to allow for OWNER, ENGINEER, and other OWNER's Representative to call in.
4. CONTRACTOR will preside at meetings.
5. Purpose of Progress Meetings: To expedite work of subcontractors or other organizations that are not meeting scheduled progress, resolve conflicts, and coordinate and expedite execution of the Work.
6. Verify:

a. Actual start and finish dates of completed activities since last progress meeting.
b. Durations and progress of activities not completed.
c. Reason, time, and cost data for Change Order Work that will be incorporated into Progress Schedule and application for payment.
d. Percentage completion of items on Application for Payment.
e. Reasons for required revisions to Progress Schedule and their effect on Contract Time and Contract Price.

7. Discuss potential problems which may impede scheduled progress and corrective measures.
8. COTNRACTOR will provide weekly digital photographs of construction for OWNER and ENGINEER. The photos shall be properly labeled prior to submission.
9. The CONTRACTOR will record minutes of meeting and distribute copies of minutes within 7 days of meeting to participants and interested parties.

B. **Monthly Progress Meetings:**

1. Conduct OWNERS monthly progress meetings at least once every month in CONTRACTORS field office. Same as weekly meeting
2. Distribute to each anticipated participant written notice and agenda of each meeting at least 4 days before meeting.
3. Invite OWNER, ENGINEER, and utility Companies when the Work affects their interests, and others necessary to agenda.
4. Complete and bring Application for Payment and Progress Schedule to progress meeting.
5. Prepare and distribute agenda.
6. CONTRACTOR will preside at meetings.
7. Review progress of the Work, Progress Schedule, narrative report, Application for Payment, record documents, and additional items of current interest that are pertinent to execution of the Work.
8. Verify:

    a. Actual start and finish dates of completed activities since last progress meeting.
    b. Durations and progress of activities not completed.
    c. Reason, time, and cost data for Change Order Work that will be incorporated into Progress Schedule and application for payment.
    d. Percentage completion of items on Application for Payment.
    e. Reasons for required revisions to Progress Schedule and their effect on Contract Time and Contract Price.

9. Discuss potential problems which may impede scheduled progress and corrective measures.
10. The CONTRACTOR will record minutes of meeting and distribute copies of minutes within 7 days of meeting to participants and interested parties.

1.6 PRE-INSTALLATION MEETINGS

A. **General:** Meet with manufacturers and installers of major units of construction which require coordination between subcontractors.

B. Distribute to each anticipated participant written notice and agenda of each meeting at least 7 days before meeting.

C. Schedule meeting at least 7 days in advance of installation.

D. Conduct meetings in CONTRACTOR's field office or other mutually agreed upon place.

E. Require attendance of Superintendent, appropriate manufacturers and installers of major units of constructions, and affected subcontractors.

F. Invite OWNER and ENGINEER.

G. CONTRACTOR will preside at meetings.

H. Record minutes of meeting and distribute copies of minutes within 7 days of meeting to participants and interested parties.

1.7 POST CONSTRUCTION MEETING

A. Meet with and inspect the Work just prior to Substantial Completion and again prior to final completion with OWNER and ENGINEER.

B. Arrange meeting at least 7 days before meeting.

C. Meet in CONTRACTOR's office or other mutually agreed upon place.

D. Inspect the Work and draft list of items to be completed or corrected.

E. Review service and maintenance contracts, and take appropriate corrective action when necessary.

F. Complete or correct defective work and extend correction period accordingly.

G. Require attendance of Superintendent, appropriate manufacturers and installers of major units of constructions, and affected subcontractors.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

-END OF SECTION-

SECTION 01329
SAFETY PLAN

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes: Development and maintenance of a Construction Safety Plan.

1.2 REFERENCES

A. OSHA.

1.3 CONSTRUCTION SAFETY PLAN

A. Detail the Methods and Procedures to comply with Federal, State, and Local Health and Safety Laws, Rules and Requirements for the duration of the Contract Times. Include the following:

1. Identification of the Certified or Licensed Safety Consultant, who will prepare, initiate, maintain and supervise safety programs, and procedures.
2. Procedures for providing workers with an awareness of safety and health hazards expected to be encountered in the course of construction.
3. Safety equipment appropriate to the safety and health hazards expected to be encountered during construction. Include warning devices, barricades, safety equipment in public right-of-way and protected areas, and safety equipment used in multi-level structures.
4. Methods for minimizing employees' exposure to safety and health hazards expected during construction.
5. Procedures for reporting safety or health hazards.
6. Procedures to follow to correct a recognized safety and health hazard.
7. Procedures for investigation of accidents, injuries, illnesses and unusual events that have occurred at the construction site.
8. Periodic and scheduled inspections of general work areas and specific work stations.
9. Training for employees and workers at the jobsite.
10. Methods of communication of safe working conditions, work practices and required personal protection equipment.

B. Assume responsibility for every aspect of Health and Safety on the jobsite, including the health and safety of Subcontractors, suppliers, and other persons on the jobsite.

1. Forward available information and reports to the Safety Consultant who shall make the necessary recommendations concerning worker health and safety at the jobsite.
2. Employ additional health and safety measures specified by the Safety Consultant, as necessary, for workers in accordance with OSHA guidelines.

C. Transmit to OWNER and ENGINEER copies of reports and other documents related to accidents or injuries encountered during construction.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

-END OF SECTION-

SECTION 01400
QUALITY CONTROL

PART 1 – GENERAL

1.1 THE REQUIRMENT

A. The Specific Quality Control Requirements for the WORK are indicated throughout the Contract Documents. The Requirements of this Section are primarily related to performance of the WORK beyond furnishing of manufactured products. The term "Quality Control" includes preactivity inspection, follow up meetings, sampling and testing, and associated requirements.

1.2 INSPECTION AT PLACE OF MANUFACTURE

A. Unless otherwise indicated, all products, materials, and equipment shall be subject to inspection by the ENGINEER at the place of manufacture.

B. Unless noted otherwise, the presence of the ENGINEER at the place of manufacturer is not required; however, this shall not relieve responsibility for providing products, materials and equipment that comply with all requirements of the Contract Documents.

1.3 SAMPLING AND TESTING

A. Unless otherwise indicated, all sampling and testing will be in accordance with the methods prescribed in the current standards of the ASTM, as applicable to the class and nature of the article or materials considered.

1.4 INSPECTION AND TESTING SERVICE

A. **Independent inspection and testing laboratory service shall comply with the following:**

1. Unless noted otherwise by the Specifications, an independent firm will be appointed and employed by the CONTRACTOR to perform special inspection and soils and concrete testing.
2. Perform inspections, testings and other services as required.
3. Submit Reports of Testing to the ENGINEER, CONTRACTOR and OWNER if required in duplicate, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.
5. CONTRACTOR to notify 48 hours prior to the expected time for operations requiring inspection and laboratory testing services is required.
6. The same independent firm on instructions shall perform retesting required because of non-conformance to requirements.
7. For tests and samples required, arrangements shall be made with an independent firm for payment and scheduling of testing. Responsibility shall be taken for the cost of sampling and testing.
8. Provide an overall report on inspection and test results for project closeout.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION

3.1 INSTALLATION

A. **Inspection:** Inspect materials or equipment upon arrival on the job site, prior to installation and reject damaged and defective items.

B. **Measurements:** Verify measurements and dimensions of the WORK, as an integral step of starting each installation.

C. **Manufacturer's Instructions:** Where installations include manufactured products, compliance with manufacturer's applicable instructions and recommendations for installation, to whatever extent these are more explicit or more stringent than applicable requirements indicated in Contract Documents is required.

- END OF SECTION -

SECTION 01420
AS BUILT DRAWINGS

PART 1 – GENERAL

1.1 THE REQUIRMENT

A. The CONTRACTOR and its Subcontractors at the start of the project shall provide a clean set of Drawings and mark on them, in large writing "As Built." This set of drawings will be kept at the job site trailer and used to indicate with a red pencil, pen or marker the "As Built" conditions of the project. These drawings will be updated as the work progresses to reflect the "As Built" conditions.

B. The CONTRACTOR shall be responsible to ensure that the "As Built" drawings are being kept up to date.

C. Upon substantial completion the CONTRACTOR shall obtain all "As Built" drawings and review them for accuracy and completeness, this includes surveying of utilities as required by Section 01722. After the CONTRACTOR has reviewed and confirmed accuracy and completeness of the "As Built" drawings the CONTRACTOR shall submit the drawings and survey information to the ENGINEER of record.

D. Upon receipt of the "As Built" drawings the ENGINEER shall make all necessary changes to the documents and provide a Record Drawing set to the CONTRACTOR for their use and distribution as required for project closeout, see Section 01700.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

-END OF SECTION-

SECTION 01450
SERVICES OF MANUFACTURER'S REPRESENTATIVE

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. **General:** Provide a qualified service representative from each equipment company manufacturing or supplying equipment to perform the duties herein described and as required by the various sections of the Specifications. All costs to perform these services shall be included in the supplier's proposal in accordance with the scope of work.

B. **Supervision of Installation:** The supplier shall provide direct and/or indirect supervision of the workers and ENGINEER, in accordance with the scope of work, to insure that proper procedures are followed during equipment installation.

C. **Equipment Check Out:**

1. After installation of the equipment has been completed and the equipment is presumably ready for operation but before it is operated by others, the representative shall inspect, operate, test and adjust the equipment. The inspection shall include but shall not be limited to, the following points as applicable:

    a. Soundness (without cracked or otherwise damaged parts)
    b. Completeness in all details as specified
    c. Correctness of setting, alignment and relative arrangement of various parts
    d. Adequacy and correctness of packing, sealing and lubricants
    e. Completeness in electrical and controls

2. The operation, testing and adjustment shall be as required to prove that the equipment has been installed properly and is capable of satisfactory operation under the conditions specified. On completion of his WORK, the CONTRACTOR, manufacturer or supplier's representatives shall submit a complete signed report of the result of his inspection, operation, adjustments and tests. The report shall include descriptions of the points inspected, tests and adjustments made, quantitative results obtained if such are specified and suggestions for precautions to be taken to ensure proper maintenance. The report also shall include a certificate that the equipment conforms to the requirements of the Contract Documents and is ready for permanent operation and that nothing in the installation will render the manufacturer's warranty null and void.

D. **Field Tests:** As required by the individual specification sections, the manufacturer's representative shall be present when the field tests are made.

E. **Operator Training:** As required by the individual specification sections, the manufacturer's representative shall provide hands-on training to maintenance personnel in the proper operation and maintenance of the equipment prior to placing the equipment in full operation.

F. **Post-startup Services:** As required by the individual specification sections, the manufacturer's representative shall provide services beyond the start up of the equipment. Services may include assistance in the calibration, tuning and troubleshooting, plus any additional training, which may be required during the agreed time after the equipment, is accepted.

G. The CONTRACTOR shall be the supplier for items not specifically included in the supplier's scope of work.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION

3.1 EXECUTION

A. The CONTRACTOR shall submit six (6) copies of all equipment field service certification documents and certificates of warranty to the ENGINEER in accordance with Section 01700 Project Closeout

- END OF SECTION -

SECTION 01505
MOBILIZATION

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. Mobilization shall include a verification by the CONTRACTOR that all permits have been obtained; moving onto the site of all plant and equipment; furnishing and erecting plants, temporary buildings and other construction facilities; and implementing security requirements; all as required for the proper performance and completion of the WORK. Mobilization shall include the following principal items:

1. Moving onto the site all materials and equipment required for first month operations
2. Installing temporary construction power, wiring and lighting facilities if applicable
3. Establishing a fire protection system as required.
4. Developing a construction water supply as required.
5. Providing field office trailers, complete with all specified furnishings and utility services (if available) including telephones, telephone appurtenances and copying machine
6. Providing all on-site communication facilities including telephones
7. Providing on-site sanitary facilities and potable water facilities
8. Arranging for and erection of work and storage yard
9. Constructing and implementing security features and requirements complying with Section 01520 - Security
10. Obtaining all required permits for the project.
11. Comply with all OSHA required notices and establish a safety program
12. Having the superintendent or authorized representatives at the job site as required for execution of the work
13. Provide and implement an on-site Construction SWPPP features and requirements complying with Section 01565 – Erosion and Sediment Control.
14. Provide and implement an on-site Dust Control Plan features and requirements complying with Section 01560 – Temporary Environmental Control.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

- END OF SECTION -

SECTION 01510
TEMPORARY UTILITIES

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. **The Temporary Utilities services available for the construction of the facility improvements as well as the associated responsibility are defined here in.**

1.2 JOB CONDITIONS

A. **Scheduled Uses:** In conjunction with establishment of Job Progress Schedule, establish a Schedule for implementation and termination of service for each temporary utility at the earliest feasible time and change over from use of temporary utility service to permanent service.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Provide new or used materials and equipment, which are in substantially undamaged condition and without significant deterioration and which are recognized in the construction industry, by compliance with appropriate standards, as being suitable for intended use in each case. The Utility Company provides a portion of temporary utility, the remaining portion with compatible materials and equipment, shall be provided and comply with recommendations of the Utility Company.

PART 3 – EXECUTION

3.1 INSTALLATION OF TEMPORARY UTILITY SERVICES

A. **General:** Wherever feasible, engage the Utility Company for installation of temporary services to the project, or at a minimum, to make a connection to the existing utility service. Locate services that will not interfere with Total Project Construction WORK; including installation of permanent utility services; maintain temporary services as installed for required period of use and relocate, modify or extend as necessary from time to time during that period as required to accommodate total project construction WORK.

B. **Approval of Electrical Connections:** Temporary connections for electricity shall be subject to approval of the OWNER and the power company representative and shall be removed in like manner, prior to final acceptance of the WORK. Electrical power is available on site for the construction of this facility and will be furnished by the OWNER. Any and all CONTRACTOR required services, connection, hookup and removals are the responsibility of the CONTRACTOR. The CONTRACTOR must submit a plan to the OWNER for review of the desired electrical connections prior to making any connections. The CONTRACTOR is responsible for coordinating the connections with the OWNER/ENGINEER prior to making any connection. Any disruption to the existing treatment facility due to the Contractor electrical connections or usage will be the responsibility of the CONTRACTOR.

C. **Separation of Circuits:** Unless otherwise permitted by the CONTRACTOR, circuits used for power purposes shall be separate from lighting circuits.

D. **Construction Wiring:** Wiring for temporary electric light and power shall be properly installed and maintained and shall be securely fastened in place. Electrical facilities shall conform to the requirements of Subpart K of the OSHA Safety and Health Standards for Construction.

3.2 INSTALLATION OF POWER DISTRIBUTION SYSTEM

A. **Power:** Provide power required for its operations under the Contract, and shall provide and maintain all temporary power lines required to perform the WORK in a safe and satisfactory manner.

3.3 INSTALLATION OF LIGHTING

A. **Construction Lighting:** WORK conducted at night or under conditions of deficient daylight shall be suitably lighted to insure proper WORK and to afford adequate facilities for inspection and safe working conditions.

B. **Temporary Lighting:** Provide a general, weatherproof, grounded temporary lighting system suitable to perform the WORK where needed.

3.4 WATER SUPPLY

A. Water is available on site for the construction of this facility and will be furnished by the OWNER.

B. **General:** The CONTRACTOR will be required to coordinate with the OWNER before making any water connections. The CONTRACTOR must submit a plan to the OWNER for review of the desired water connections prior to making any connections. For each such connection made, first attach to the pipeline a valve, and backflow preventer as required by the OWNER. The Contractor is responsible for installation and removal of all facilities necessary to convey the water from the source to the points of usage.

C. **Bottled Water:** The CONTRACTOR is responsible for any and all bottled water brought to the site.

3.5 INSTALLATION OF SANITARY FACILITIES

A. **Toilet Facilities:** Fixed or portable chemical toilets shall be provided wherever needed for the use of employees. Toilets at construction job sites shall conform to the requirements of Subpart D, Section 1926.51 of the OSHA Standards for Construction.

3.7 INSTALLATION OF COMMUNICATIONS

A. **Telephone Services:** Provide and maintain at all times during the progress of the WORK not less than one telephone in good working order at its own field construction office at or near the Site. Each such telephone shall be connected to an established exchange for toll service and with all other telephones utilized. Cell phones are an acceptable alternative to land lines.

3.8 OPERATIONS AND TERMINATIONS

A. **Inspections:** Prior to placing temporary utility services into use, Inspect and test each service and arrange for governing authorities' required inspection and tests, and obtain required certifications and permits for use thereof.

B. **Protection:** Maintain distinct markers for underground lines, and protect from damage during excavating operations.

C. **Termination and Removal:** When need for a temporary utility service or a substantial portion thereof has ended, or when its service has been replaced by use of permanent services, or not later than time of substantial completion, promptly remove installation unless requested to retain it for a longer period. Complete and restore WORK, which may have been delayed or affected by installation and use of temporary utility, including repairs to construction and grades and restoration and cleaning of exposed surfaces.

- END OF SECTION -

SECTION 01520
SECURITY

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. Security shall be provided by CONTRACTOR as agreed upon in the contract to protect the project as defined in the Contract as follows:

1. Protect WORK, existing premises and operations from theft, vandalism and unauthorized entry.
2. Initiate program in coordination with existing security system at mobilization.
3. Maintain program throughout construction period.

B. Entry Control

1. Restrict entry of persons and vehicles into Site.
2. Allow entry only to authorized persons with proper identification.
3. Provide all temporary barriers in conformance with Local, State and Federal Codes.
4. Control entrance of persons and vehicles related to operations.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

- END OF SECTION -

SECTION 01530
PROTECTION OF EXISTING FACILITIES

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall protect all existing utilities and improvements, not designated for removal, and shall restore damaged or temporarily relocated utilities and improvements to a condition equal to or better than prior to such damage or temporary relocation, all in accordance with the Contract Documents.

B. Submit Protection Plan prior to commencement of Work in accordance to Section 01300 Submittals.

1.2 RIGHTS-OF-WAY

A. WORK that would affect any oil, gas, sewer, or water pipeline; any telephone, telegraph, or electric transmission line; any fence; or any other structure, shall not be performed nor shall the entry upon the rights-of-way involved until notified that authority has been secured from the proper party.

B. After authority has been obtained, said party shall be given due notice of its intention to begin work, if required by said party, and shall remove, shore, support, or otherwise protect such pipeline, transmission line, ditch, fence, or structure, or replace the same.

1.3 RESTORATION OF PAVEMENT

A. **General:** All paved areas including asphaltic concrete berms cut or damaged during construction shall be replaced with similar materials of equal thickness to match the existing adjacent undisturbed areas, except where specific resurfacing requirements have been called for in the Contract Documents or in the requirements of the agency issuing the permit. The pavement restoration requirement to match existing sections shall apply to all components of existing sections, including sub-base, base, and pavement. Temporary and permanent pavement shall conform to the requirements of the affected pavement owner. Pavements that are subject to partial removal shall be neatly saw cut in straight lines.

1.4 EXISTING UTILITIES AND IMPROVEMENTS

A. **General:** Protect underground Utilities and other improvements, which may be impaired during construction operations, regardless of whether or not the Utilities are indicated on the Drawings. Take all possible precautions for the protection of unforeseen Utility lines to provide for uninterrupted service and to provide such special protection as may be necessary.

B. Except where the Drawings indicate Utilities have been field located during design or certain Utility locations shall be exposed as part of the WORK, responsibility for exploratory excavations as it deems necessary to determine the exact locations and depths of Utilities, which may interfere with its work shall be required. All such exploratory excavations shall be performed as soon as practicable after Notice to Proceed and, in any event, a sufficient time in advance of construction to avoid possible delays progress.

C. The number of exploratory excavations required shall be that number which is sufficient to determine the alignment and grade of the utility.

D. **OWNER's Right of Access:** The right is reserved to the owners of public utilities and franchises to enter at any time upon any public street, alley, right-of-way, or easement for the purpose of making changes in their property made necessary by the WORK of this Contract.

E. **Underground Utilities Indicated:** Existing Utility lines that are indicated or the locations of which are made known prior to excavation and that are to be retained. All Utility lines that are constructed during excavation operations shall be protected from damage during excavation and backfilling if damaged, shall be immediately repaired or replaced, unless otherwise repaired by the owner of the damaged Utility. If the owner of the damaged facility performs its own repairs, reimbursement to said owner for the costs of repair shall be required.

F. **Underground Utilities Not Indicated:** In the event that the existing Utility lines are damaged that are not indicated or the locations of which are not made known prior to excavation, a verbal report of such damage shall be made immediately, and a written report thereof shall be made promptly thereafter. Immediately notify the owner of the damaged Utility. If directed, repairs shall be made under the provisions for changes and extra work contained in their Contract Agreement.

G. Costs of locating and repairing damage, not due to failure to exercise reasonable care and removing or relocating such Utility facilities, not indicated in the Contract Documents, with reasonable accuracy and for equipment on the project, which was actually working on that portion of the WORK which was interrupted or idled by removal or relocation of such Utility facilities, and which was necessarily idled during such work will be paid for as extra work resulting in the issuing of a change order in accordance with the provisions of the Contractual Agreement.

H. **Approval of Repairs:** All repairs to a damaged Utility or improvement are subject to inspection and approval by an authorized representative of the Utility or improvement owner before being concealed by backfill or other work.

I. **Maintaining in Service:** Unless indicated otherwise, oil and gasoline pipelines, power, and telephone or the communication cable ducts, gas and water mains, irrigation lines, sewer lines, storm drain lines, poles, and overhead power and communication wires and cables encountered along the line of the WORK shall remain continuously in service during all the operations under the Contract, unless other satisfactory arrangements are made with the owner of said pipelines, duct, main, irrigation line, sewer, storm drain, pole, or wire or cable. Responsible for and shall repair all damage due to its operations shall be required, and the provisions of this Section shall not be abated even in the event such damage occurs after backfilling or is not discovered until after completion of the backfilling.

1.5 NOTIFICATION

A. Prior to any excavation in the vicinity of any existing underground facilities, including all water, sewer, storm drain, gas, petroleum products, or other pipelines; all buried electric power, communications, or television cables; all traffic signal and street lighting facilities; and all roadway and state highway rights-of-way, notify the respective authorities representing the owners or agencies responsible for such facilities not less than 3 days nor more than 7 days prior to excavation so that a representative of said owners or agencies can be present during such work if they so desire.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

- END OF SECTION -

SECTION 01550
SITE ACCESS AND STORAGE

PART 1 – GENERAL

1.1 HIGHWAY LIMITATIONS

A. Make investigation of the condition of available public and private roads and of clearances, restrictions, bridge load limits, and other limitations affecting transportation and ingress and egress to the site of the WORK.

1.2 TEMPORARY CROSSINGS

A. **General:** Continuous, unobstructed, safe, and adequate pedestrian and vehicular access shall be provided. Vehicular access to residential driveways shall be maintained to the property line.

B. **Street Use:** Nothing herein shall be construed to entitle any entity to the exclusive use of any public street, alleyway or parking area during the performance of the WORK hereunder, and it shall so conduct its operations as not to interfere unnecessarily with the authorized work of utility companies or other agencies in such streets, alleyways or parking areas. No streets shall be closed to the public without first obtaining permission from the proper governmental authority. Where excavation is being performed in primary streets or highways, one lane in each direction shall be kept open to traffic at all times unless otherwise indicated. Toe boards shall be provided to retain excavated material if required by the ENGINEER or the agency having jurisdiction over the street or highway. Fire hydrants on or adjacent to the WORK shall be kept accessible to fire-fighting equipment at all times. Temporary provisions shall be made to assure the use of sidewalks and the proper functioning of all gutters, storm drain inlets and other drainage facilities.

C. **Traffic Control:** For the protection of traffic in public or private streets and ways, provide, place, and maintain all necessary barricades, traffic cones, warning signs, lights and other safety devices.

1. Take all necessary precautions for the protection of the WORK and the safety of the public. Barricades and obstructions shall be illuminated at night and all lights shall be kept burning from sunset until sunrise. Station guards or flaggers may be required by the public authorities within their respective jurisdictions in order to conform to such special safety regulations relating to traffic control Signs, signals and barricades shall conform to the requirements Subpart G, Part 1926, of the OSHA Safety and Health Standards for Construction.

1.3 WORK AND STORAGE AREA

A. Designate and arrange for the use, a portion of the property adjacent to the WORK for its exclusive use during the term of the Contract as storage and shop area for its construction operations relative to this Contract.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

- END OF SECTION -

SECTION 01560
TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 – GENERAL

1.1 EXPLOSIVES AND BLASTING

A. The use of explosives on the WORK will not be permitted.

1.2 RUBBISH CONTROL

A. During the progress of the WORK, the CONTRACTOR shall keep the Site and other areas used by it in a neat and clean condition, and free from any accumulation of rubbish. Dispose of all rubbish and waste materials of any nature occurring at the Site, and shall establish regular intervals of collection and disposal of such materials and waste. Keep its haul roads free from dirt, rubbish and unnecessary obstructions resulting from its operations. Disposal of all rubbish and surplus materials shall be off the Site in accordance with local codes and ordinances governing locations and methods of disposal, and in conformance with all applicable safety laws, and to the particular requirements of Part 1926 of the OSHA Safety and Health Standards for Construction.

1.3 SANITATION

A. **Toilet Facilities:** The CONTRACTOR shall provide fixed or portable chemical toilets wherever needed for the use of employees. Toilets at construction job sites shall conform to the requirements of Part 1926 of the OSHA Standards for Construction.

B. **Sanitary and Other Organic Wastes:** The CONTRACTOR shall establish a regular daily collection of all sanitary and organic wastes. All wastes and refuse from sanitary facilities provided or organic material wastes from any other source related to operations shall be disposed of away from the Site in accordance with all laws and regulations pertaining thereto.

1.4 CHEMICALS

A. All chemicals used or furnished by the CONTRACTOR for or during project construction, whether defoliant, soil sterilant, herbicide, pesticide, disinfectant, polymer, reactant or of other classification, shall show approval of either the U.S. Environmental Protection Agency or the U.S. Department of Agriculture. Use of all such chemicals and disposal of residues shall be in strict accordance with the printed instructions of the manufacturer.

1.5 CULTURAL RESOURCES

A. Attention is directed to the National Historic Preservation Act of 1966 (16 U.S.C. 470) and 36 CFR 800, which provides for the preservation of potential historical architectural, archaeological, or cultural resources (hereinafter called "cultural resources").

B. Conform to the applicable requirements of the National Historic Preservation Act of 1966 as it relates to the preservation of cultural resources.

C. In the event potential cultural resources are discovered during subsurface excavations at the site of construction, the following procedures shall be instituted:

1. The CONTRACTOR shall issue a Field Order directive to cease all construction operations at the

location of such potential cultural resources find.

2. Such Field Order shall be effective until such time as a qualified archaeologist can be called to assess the value of these potential cultural resources and make recommendations to the State Historic Preservation Office.

D. If the archaeologist determines that the potential find is a bona fide cultural resource, at the direction of the State Historic Preservation Office, work shall be suspended at the location of the find under the provisions for changes contained in the Contractual Agreement.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

- END OF SECTION -

SECTION 01561
TEMPORARY FENCING

PART 1 – GENERAL

1.1 SUMMARY

A. Contractor shall determine temporary fence type, layout, and location of gates. Construction and maintenance of temporary fencing shall be provided by the contractor.

B. In general, the overall site of the existing Waste Water Facility is already fenced. It will be the Contractors responsibility to determine there needs to secure there yard/staging areas as will as any and all construction sites or activities with in the project. It is the OWNERS opinion that the plastic orange fence will be sufficient to provide safety and security surrounding the work activities; however it is the contractor's responsibility to make the final determination. The OWNER will not be responsible in any manner for any missing, stolen, or damaged to any and all contractor property, yard, equipment or construction activity, this is the contractors responsibility.

1.2 SUBMITTALS

A. Submit in accordance with Section 01300, "Submittal Procedures":

1. Shop drawing indicating layout of temporary fencing, location and size of gates, existing pavement and roads, access to fire hydrants and hose connections, and other site specific conditions. Prepare drawing after site observation and verification of existing conditions.

PART 2 – PRODUCTS

2.1 TEMPORARY CHAIN LINK FENCING

A. Unless otherwise indicated, type of temporary chain link fencing shall be Contractor's option. Following types are acceptable:

1. New Materials or previously used salvage chain link fencing in good condition.
2. Posts: Galvanized steel pipe of diameter to provide rigidity. Post shall be suitable for setting in concrete footings, driving into ground, anchoring with base plates, or inserting in precast concrete blocks.
3. Fabric: Woven galvanized steel wire mesh. Provide in continuous lengths to be wire tied to fence posts or prefabricated into modular pipe-framed fence panels.

B. Gates: Provide personnel and vehicle gates of the quantity and size required for functional access to site.

1. Fabricate of same material as used for fencing
2. Vehicle gates:

a. Minimum width: 20 feet to allow access for emergency vehicles
b. Capable of manual operation by one person.

2.2 PLASTIC MESH FENCING

A. Where required to provide visual warning and control, provide plastic mesh fencing supported by steel posts

driven into ground or set in precast concrete blocks

B. Height: 36 inches minimum

C. Color: Safety orange

PART 3 – EXECUTION

3.1 LAYOUT

A. Access: Provide gates for personnel, delivery of materials, and access by emergency vehicles.

3.2 INSTALLATION

A. Plastic mesh fencing: Space steel support posts to ensure mesh remains vertical and at proper height. Securely tie mesh to posts.

3.3 MAINTENANCE AND REMOVAL

A. Maintain fencing in good condition. If damaged, immediately repair.

B. Remove temporary fencing upon completion of Work or when no longer required for security or control. Backfill holes and compact. Holes in pavement shall be surfaced to match existing paving. Repair damage caused by installation of temporary fencing.

- END OF SECTION -

SECTION 01563
DUST CONTROL

PART 1 – GENERAL

1.1 DUST ABATEMENT

A. Preventative measures to limit the production of dust in amounts damaging to property, cultivated vegetation or domestic animals, or causing a nuisance to persons living in or occupying buildings in the vicinity shall be taken in to account. Responsibility for any damage resulting from dust originating from its operations shall be the CONTRACTOR's. The dust abatement measures shall be maintained at all times during construction of the project, in accordance with the requirements of Cochise County.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION

3.1 GENERAL

The CONTRACTOR shall take necessary measures to control any and all dust related to or as a result of construction activities under this Contract. The water necessary for the dust control operation will be Owner furnished, beyond that the CONTRACTOR shall be responsible to provide whatever means necessary to accomplish the task of Dust Control. The CONTRACTOR shall be responsible for any damage resulting from dust originating from construction activities under this Contract.

- END OF SECTION -

SECTION 01565
EROSION AND SEDIMENT CONTROLS

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. Perform all WORK and take all measures necessary to control soil erosion resulting from construction operations, to prevent the flow of sediment from the site, to contain construction materials (including excavation and backfill) within the protected working area, and to stabilize soil banks from erosion caused by stormwater flood zones so as to, prevent damage to the adjacent water courses and to the project site.

B. Do not employ any construction method that violates a rule, regulation, guideline or procedure established by Federal, State or local agencies having jurisdiction over the environmental effects of construction.

C. Pollutants such as chemicals, fuels, lubricants, bitumen, raw sewage and other harmful waste shall not be discharged into or alongside of any body of water or into natural or man-made channels leading thereto.

D. Prepare and submit a Stormwater Prevention Plan to the ENGINEER for his records in accordance with ADEQ and with the plans as provided with in the Construction Documents. The CONTRACTOR is responsible for all aspects of this plan, its monitoring, maintaining of the reports and keeping a copy of documents on site as required by ADEQ.

E. Prepare and submit a monitoring program and reporting plan to the ENGINEER for his records in accordance with ADEQ. Submit to the ENGINEER for his records on a monthly basis copies of the monitoring reports taken through out the month.

F. Prepare and submit the Notice of Intent (NOI) as required by ADEQ. Submit Copy of NOI to the ENGINEER for his records.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Bales may be hay or straw, and shall be reasonably clean and free of noxious weeds and deleterious materials.

B. Filter fabric for sediment traps shall be of suitable materials acceptable to the ENGINEER.

C. Bank stabilization shall be durable UV resistant high performance turf reinforcement mats (HP TRMs). Tensile strength of 4000 lb/ft meets US EPA definition of a high performance TRM. Acceptable products are Pyramat or Engineer approved equal.

PART 3 – EXECUTION

3.1 METHODS OF CONSTRUCTION

A. Use any of the acceptable methods necessary to control soil erosion and prevent the flow of sediment to the maximum extent possible. These methods shall include, but not be limited to, the use of bank reinforcement liners, water diversion structures, diversion ditches and settling basins.

B. Construction operations shall be restricted to the areas of work indicated on the Drawings and to the area, which may be entered for the construction of temporary or permanent facilities. The authority to limit the

surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and fill operations shall be given. The CONTRACTOR shall provide immediate permanent or temporary pollution control measures to prevent contamination of the wetlands and adjacent watercourses. Such work may involve the construction of temporary berms, dikes, dams, sediment basins, slope drains and use of temporary mulches, mats, or other control devices or methods as necessary to control erosion. The cost of this work shall be borne by the CONTRACTOR.

C. Excavated soil material shall not be placed adjacent to wetlands or watercourses in a manner that will cause it to be washed away by high water or runoff. Earth berms, turf reinforcement mats, or diversions shall be constructed or placed to intercept and divert runoff water away from critical areas. Diversion outlets shall be stable or shall be stabilized by mean acceptable to the ENGINEER. Turf reinforcement shall be placed as specified by the manufacturer. If for any reason construction materials are washed away during the course of construction, the CONTRACTOR shall remove those materials from the fouled areas.

D. For Work within easements of rights-of-way, all materials used in construction such as excavation, backfill, roadway, and pipe bedding and equipment shall be kept within the limits of these easements or rights-of-way.

E. The CONTRACTOR shall not pump silt-laden water from trenches or other excavation into the wetlands, or adjacent watercourses. Instead, silt-laden water from his excavations shall be discharged within areas surrounded by baled hay or into sediment traps to ensure that only sediment-free water is returned to the watercourses. Damage to vegetation by excessive watering or silt accumulation in the discharge area shall be avoided.

F. **Prohibited construction procedures include, but are not limited to the following:**

1. Dumping of spoil material into any streams, wetlands, surface waters or unspecified locations.
2. Indiscriminate, arbitrary or capricious operation of equipment in wetlands or surface waters.
3. Pumping of silt-laden water from trenches or excavations into surface waters, or wetlands.
4. Damaging vegetation, adjacent to or outside the construction area limits.
5. Disposal of trees, brush, debris, paints, chemicals, asphalt products, concrete curing compounds, fuels, lubricants, insecticides, wash water from concrete trucks or hydroseeders, or any other pollutant in wetlands, surface waters, or unspecified locations.
6. Permanent or unauthorized alternation of the flow line of any stream.
7. Open burning of debris from the construction work.

G. Any temporary working roadways required shall be clean fill approved by the ENGINEER. In the event fill is used, the CONTRACTOR shall take every precaution to prevent the fill from mixing with native materials of the site. All such foreign fill materials shall be removed from the site following construction.

- END OF SECTION -

SECTION 01600
PRODUCTS, MATERIALS, EQUIPMENT AND SUBSTITUTIONS

PART 1 – GENERAL

1.1 DEFINITIONS

A. The word "Products" as used in the Contract Documents is defined to include purchased items for incorporation into the WORK, regardless of whether specifically purchased for the project or taken from stock of previously purchased products. The word "Materials," is defined as products which must be substantially cut, shaped, worked, mixed, finished, refined or otherwise fabricated, processed, installed or applied to form WORK. The word "Equipment" is defined as products with operational parts, regardless of whether motorized or manually operated, and particularly including products with service connections (wiring, piping and other like items). Definitions in this paragraph are not intended to negate the meaning of other terms used in the Contract Documents, including "specialties," "systems," "structure," "finishes," "accessories," "furnishings," special construction" and similar terms, which are self-explanatory and have recognized meanings in the construction industry.

B. Neither "Products" nor "Materials" nor "Equipment" includes machinery and equipment used for preparation, fabrication, conveying and erection of the WORK.

1.2 QUALITY ASSURANCE

A. **Source Limitations:** To the greatest extent possible for each unit of WORK, the CONTRACTOR shall provide products, materials and equipment of a singular generic kind from a single source.

B. **Compatibility of Options:** Where more than one choice is available as options for selection of a product, material or equipment, select an option, which is compatible with other products, materials or equipment. Compatibility is a basic general requirement of product, material and equipment selections.

1.3 PRODUCT DELIVERY AND STORAGE

A. Deliver and store the product in accordance with manufacturer's written recommendations and by methods and means that will prevent damage, deterioration and loss including theft. Delivery schedules shall be controlled to minimize long-term storage of products at the Site and overcrowding of construction spaces. In particular, ensure coordination to ensure minimum holding or storage times for flammable, hazardous, easily damaged or sensitive materials to deterioration, theft, and other sources of loss.

1.4 TRANSPORTATION AND HANDLING

A. Products shall be transported by methods to avoid damage and shall be delivered in undamaged condition in manufacturer's unopened containers and packaging.

B. Provide equipment and personnel to handle products, materials and equipment by methods to prevent soiling and damage.

C. Provide additional protection during handling to prevent marring and otherwise damaging products, packaging, and surrounding surfaces.

1.5 STORAGE AND PROTECTION

A. Products shall be stored in accordance with manufacturer's written instructions and with seals and labels intact and legible. Sensitive products shall be stored in weather-tight climate controlled enclosures and temperature and humidity ranges shall be maintained within tolerances required by manufacturer's recommendations.

B. For exterior storage of fabricated products, products shall be placed on sloped supports above ground. Products subject to deterioration shall be covered with impervious sheet covering and ventilation shall be provided to avoid condensation.

C. Loose granular materials shall be stored on solid flat surfaces in a well-drained area and shall be prevented from mixing with foreign matter.

D. Storage shall be arranged to provide access for inspection. Periodically inspect to assure products are undamaged and are maintained under required conditions.

E. Storage shall be arranged in a manner to provide access for maintenance of stored items and for inspection.

1.6 MAINTENANCE OF PRODUCTS IN STORAGE

A. Stored products shall be periodically inspected on a scheduled basis.

B. Comply with manufacturer's product storage requirements and recommendations.

C. Maintain manufacturer-required environmental conditions continuously.

D. Ensure that surfaces of products exposed to the elements are not adversely affected and that weathering of finishes does not occur.

E. For mechanical and electrical equipment, provide a copy of the manufacturer's service instructions with each item and the exterior of the package shall contain notice that instructions are included.

F. Products shall be serviced on a regularly scheduled basis, and a log of services shall be maintained and submitted as a record document prior to final acceptance by the ENGINEER in accordance with the Contract Documents.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

- END OF SECTION -

SECTION 01700
PROJECT CLOSEOUT

PART 1 – GENERAL

1.1 RELATED REQUIREMENTS

A. **Related Sections:**

1. Section 00700 – General Conditions
2. Section 01710 – Cleaning

1.2 SUBSTANTIAL COMPLETION

A. Substantial completion for this project is defined as all permits have been completed and submitted to the proper agencies and the photovoltaic system is complete and ready for APS inspection and approval.
B. Submit written certification to that the projects phase is substantially complete.
C. Submit list of major items to be completed or corrected.
D. Engineer will make an inspection within seven days after receipt of certification, together with a representative.
E. **Should ENGINEER consider that work is substantially complete:**

1. Prepare, and submit to ENGINEER, a list of the items to be completed or corrected, as determined by on-site observation.
2. Engineer will prepare and issue a Certificate of Substantial Completion, containing:

a. Date of Substantial Completion.
b. List of items to be completed or corrected, verified and amended.
c. The time required to complete or correct work of listed items.
d. Responsibilities for:

1) Insurance
2) Utilities
3) Operation of mechanical, electrical and other systems
4) Maintenance and cleaning
5) Security

e. Signatures of: ENGINEER

3. Complete work listed for completion or correction, within designated time.

F. **Should ENGINEER consider that work is not substantially complete:**

1. He shall immediately notify, in writing, stating reasons.
2. Complete work, and send second written notice to ENGINEER, certifying that Project, or designated portion of project of substantially complete.
3. ENGINEER will re-review work.

1.3 FINAL INSPECTION

A. **Submit written certification that:**

1. Contract Documents have been reviewed.
2. Project has been inspected for compliance with Contract Documents.
3. Work has been completed in accordance with Contract Documents.
4. Equipment and systems have been tested in presence of ENGINEER and are operational.
5. Project is completed and ready for final inspection.

B. ENGINEER will make final on-site observation/review within seven (7) days after receipt of certification.

C. Should ENGINEER consider that work is finally complete in accordance with requirements of Contract Documents, he shall prepare and issue the following:

1. Certificate of Completion;
2. Complete sets of As-Builts received; and
3. A Request to make Project Closeout submittals.

D. **Should ENGINEER consider that work is not finally complete:**

1. He shall notify, in writing, stating reasons.
2. Take immediate steps to remedy the stated deficiencies, and send second written notice to ENGINEER certifying that work is complete.
3. ENGINEER will re-review the work.

1.4 FINAL CLEANING UP

A. The work will not be considered as completed and final payment made until all final cleanup has been done in a satisfactory manner. See Section 01710 for detailed requirements.

1.5 CLOSEOUT SUBMITTALS

A. Submit the following Closeout Submittals upon completion of the Work and at least 7 days prior to submitting Application for Final Payment:

1. Evidence of Compliance and Closeout with Requirements of Governing Authorities.
2. Project Record Documents.
3. Hydrostatic Test Results Documentation for Concrete Structures Section 03936.
4. Operation and Maintenance Manuals.
5. Equipment Field Service Installation, Certification, Certificate of Warranty and Evidence of Training per Section 01450.
6. Warranties and Bonds.
7. Keys and Keying Schedule.
8. Evidence of Payment and Release of Liens as outlined in Conditions of the Contract.
9. Release of claims as outlined in Conditions of the Contract.
10. Completed As-built Drawings and Documentation.
11. Survey Record Documents as specified in Section 01722.
12 Certificate of Final Completion.

1.6 EVIDENCE OF COMPLIANCE WITH REQUIREMENTS OF GOVERNING AUTHORITIES

A. Submit the following:

1. Certificate of Occupancy:
2. Certificate of Inspection:

a. Mechanical:

1) Form U-1 "Manufacturer's Data Report for Unfired Pressure Vessels" for each pressure vessel furnished and installed.
2) City of Bisbee.

b. Electrical

1) City of Bisbee.

1.7 PROJECT RECORD DOCUMENTS

A. Maintain at Project site, available to OWNER and ENGINEER, one copy of the Contract Documents, shop drawings and other submittals, in good order.

1. Mark and record field changes and detailed information contained in submittals and change orders.
2. Record actual depths, horizontal and vertical location of underground pipes, duct banks and other buried utilities. Reference dimensions to permanent surface features.
3. Identify specific details of pipe connections, location of existing buried features located during excavation, and the final locations of piping, equipment, electrical conduits, manholes, and pull boxes.
4. Identify location of spare conduits including beginning, ending and routing through pull boxes, and manholes. Record spare conductors, including number and size, within spare conduits, and filled conduits.
5. Provide schedules, lists, layout drawings, and wiring diagrams.
6. Make annotations with erasable colored pencil conforming to the following color code:

Additions:	Red
Deletions:	Green
Comments:	Blue
Dimensions:	Graphite

B. Maintain documents separate from those used for construction.

1. Label documents "RECORD DOCUMENTS"

C. Keep documents current:

1. Record required information at the time the material and equipment is installed and before permanently concealing.

D. Deliver record documents with the transmittal letter containing date, Project title, CONSTRUCTION MANAGER'S name and address, list of documents, and signature of CONSTRUCTION MANAGER.

E. During progress meetings, record documents will be reviewed to ascertain that changes have been recorded.

1.8 WARRANTIES AND BONDS

A. Provide executed Warranty or Guaranty Form if required by Contract Documents.

B. Provide specified additional warranties, guarantees, and bonds form manufacturers and suppliers.

1.9 CERTIFICATE OF FINAL COMPLETTION

A. When 7-day operational test has been successfully completed, ENGINEER will certify that new facilities are operationally complete. ENGINEER will submit a list of known items (punchlist) still to be completed or corrected prior to contract completion.

B. List of items to be completed or corrected will be amended as items are resolved by CONSTRUCTION MANAGER.

C. When all items have been completed or corrected, submit written certification that the entire work is complete in accordance with the Contract Documents and request final inspection.

D. Upon completion of final inspection, ENGINEER will either prepare a written acceptance of the entire work or advise CONSTRUCTION MANAGER of work not complete. If necessary, inspection procedures will be repeated.

1.10 FINAL APPLICATION FOR PAYMENT

A. Submit final applications in accordance with requirements of Contractual Agreement.

1.11 FINAL CERTIFICATE FOR PAYMENT

A. ENGINEER will issue final certificate in accordance with provisions of Contractual Agreement.

- END OF SECTION -

SECTION 01710
CLEANING

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. On a continuous basis, maintain premises free from accumulations of waste, debris and rubbish, caused by operations.

B. At completion of WORK, remove waste materials, rubbish, tools, equipment, machinery and surplus materials, and clean all sight-exposed surfaces; leave Project clean and ready for operation/occupancy.

C. **Related Sections:**

1. Section 01045 – Cutting and Patching
2. Section 01700 – Project Closeout

1.2 SAFETY REQUIREMENTS

A. **Hazards control:**

1. Store volatile wastes in covered metal containers, and remove from premises daily.
2. Prevent accumulation of wastes, which create hazardous conditions.
3. Provide adequate ventilation during use of volatile or noxious substances.

B. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.

1. Do not burn or bury rubbish and waste materials on Project site without written permission from the OWNER.
2. Do not dispose of volatile wastes such as mineral spirits, oil or paint thinner in storm or sanitary drains.
3. Do not dispose of wastes into streams or waterways.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

B. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 – EXECUTION

3.1 DURING CONSTRUCTION

A. Execute cleaning to ensure that grounds and public properties are maintained free from accumulations of waste materials and rubbish.

B. Wet down dry materials and rubbish to prevent blowing dust.

C. At reasonable intervals during progress of Work, clean site and public properties, and dispose of waste materials, debris and rubbish.

D. Provide on-site containers for collection of waste materials, debris and rubbish.

E. Remove waste materials, debris and rubbish from site and legally dispose of at public or private dumping areas off OWNER's property.

F. Handle materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights.

G. Each subcontractor areas of work shall thoroughly be cleaned of all materials and equipment installed from their areas of work.

3.2 FINAL CLEANING

A. Employ experienced workers, or professional cleaners, for final cleaning.

B. In preparation for substantial completion, conduct final inspection of sight-exposed interior and exterior surface, and of concealed spaces.

C. Repair, patch and touch up marred surfaces to specified finish, to match adjacent surfaces.

D. Broom clean paved surfaces; rake clean other surfaces of grounds.

E. Maintain cleaning until Project, or portion thereof, is occupied by OWNER.

F. The CONTRACTOR shall restore or replace existing property or structures as promptly and practicable as work progresses.

- END OF SECTION -

SECTION 01722
FIELD ENGINEERING

PART 1 – GENERAL

1.1 SUMMARY

A **Section Includes:** Field engineering to establish lines and grades for the Work.

B. **Related Sections:** Section 01700 – Project Closeout

1.2 THE REQUIREMENT

A. The CONTRACTOR shall provide the initial surveying and staking control for the project. In addition, the CONTRACTOR shall provide the initial staking of the property and easement limits, clearing limits, influent and effluent lines, utilities, and excavation limits staking of structure corners with offsets as necessary for construction.

B. The CONTRACTOR shall provide all necessary staking following the OWNER initial staking as completed during the design of this project, as required to construct all items included in the plans and Scope of Work.

C. The ENGINEER shall survey the location of any underground utility line that the CONTRACTOR installs. This shall include all joints, hydrants and services. The CONTRACTOR shall notify the ENGINEER 48 hours in advance of backfilling to allow scheduling.

1.3 QUALITY ASSURANCE

A. **Qualifications of Surveyor or Engineer:** Registered civil engineer or land surveyor in state where Project is located.

B. Accuracy of stakes, alignments, and grades may be checked randomly by ENGINEER.

1. Notice of when checking will be conducted will be given.
2. When notice of checking is given, postpone parts of the Work affected by stakes, alignments or grades to be checked until checked.
3. Do not assume that ENGINEER's check substitutes or complements required field quality control procedures.

1.4 CONSTRUCTION STAKES, LINES, AND GRADES

A. Execute the Work in accordance with the lines and grades indicated.

B. Make distances and measurements on horizontal planes, except elevations and structural dimensions.

1.5 SURVEY REFERENCE POINTS

A. Basic reference line, a beginning point on basic reference line, and a bench mark will be provided, by OWNER as defined in the Contract.

B. From these reference points, establish other control and reference points as required to properly lay out the Work.

C. Locate and protect control points prior to starting sitework, and preserve permanent reference points during construction.

1. Make no changes or relocations without prior written notice.
2. Replace Project control point, when lost or destroyed, in accordance with original survey control.

D. Set monuments for principal control points and protect them from being disturbed and displaced.

1. Re-establish disturbed monuments.
2. When disturbed, postpone parts of the Work that are governed by disturbed monuments until such monuments are re-established.

1.6 PROJECT SURVEY REQUIREMENTS

A. Establish minimum of 2 permanent bench marks on site referenced to data established by survey control points.

B. Record permanent bench mark locations with horizontal and vertical data on Project Record Documents.

C. Assume responsibility for accuracy of stakes, alignments, and grades by performing verifications and checking in accordance with standard surveying practice.

D. Locate all utilities installed within the project prior to backfilling. Make a complete survey at the line, hub, or joint locations.

1.7 RECORD DOCUMENTS

A. Once the CONTRACTOR has reached substantial completion the ENGINEER will survey the site in preparation of Record Documents in conjunction with the CONTRACTORS supplied as-built as specified in Section 01420. The Owners final survey does not relieve the CONTRACTOR from his contractual responsibly.

B. Carefully note all deviations or changes from the original drawings and maintain complete, accurate log of control points and survey.

C. Submit all utility locate information and surveyed information in hard copy and AutoCAD format.

D. Affix civil engineer's or land surveyor's signature and registration number to Record Drawing to certify accuracy of information shown.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION

3.1 GENERAL

A. The CONTRACTOR shall provide the initial surveying and staking control for the project. In addition, the CONTRACTOR shall provide the initial staking of the property and easement limits, clearing limits, influent and effluent lines, utilities, and excavation limits staking of structure corners with offsets as necessary for construction

B. The CONTRACTOR shall provide all required field engineering as necessary to complete the work as defined in the contract.

- END OF SECTION -

SECTION 01730
OPERATING AND MAINTENANCE DATA

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. Compile product data and related information appropriate for maintenance and operation of equipment furnished under the Contract. Prepare Operating and Maintenance Manual as specified.

B. Instruct OWNER's personnel in the maintenance and operation of equipment and systems as outlined herein.

C. In addition to Operating and Maintenance Data, the Manufacturer's printed recommended Installation Practice shall be included. If not part of the Operating and Maintenance Manual, separate written installation instructions shall be provided, serving to assist the CONTRACTOR in equipment installation.

D. **Related Sections:**

1. Section 00700 – General Conditions
2. Section 01300 – Submittals

1.2 OPERATING AND MAINTENANCE MANUAL

A. Every piece of equipment furnished and installed shall be provided with complete maintenance and operations manuals. These shall be detailed in instructions to the OWNER's personnel. They shall be attractively bound for the OWNER's records. After approval, the CONTRACTOR shall store all manuals until the completion of the project or until requested by the ENGINEER. The manuals will be stored and delivered to the OWNER in an organized format.

B. Provide three (3) hard copies plus one (1) electronic version in PDF format. Two (2) copies shall be delivered to the jobsite shipped with the equipment and one (2) copies shall be delivered to the CONTRACTOR's main office.

1.3 SUBMITTALS

A. Submittals shall be made in accordance with Section 01300 - Submittals.

1.4 CONTENT OF MANUAL

A. Neatly typewritten table of contents for each volume, arranged in systematic order.

1. CONTRACTOR, name of responsible principal, address and telephone number.
2. A list of each product required to be included, indexed to the content of the volume.
3. List, with each product, the name, address and telephone number of:

   a. Subcontractor or installer.
   b. Maintenance contractor, as appropriate.
   c. Identify the area of responsibility of each.
   d. Local source of supply for parts and replacement.

4. Identify each product, by product name and other identifying symbols as set forth in Contract Documents.

B. **Product Data:**

1. Include only those sheets, which are pertinent to the specific product. References to other sizes and types or models of similar equipment shall be deleted or lined out.
2. Annotate each sheet to:

    a. Clearly identify the specific product or part installed.
    b. Clearly identify the data applicable to the installation.
    c. Provide a parts list for all new equipment items, with catalog numbers and other data necessary for ordering replacement parts.
    d. Delete references to inapplicable information.

3. Clear and concise instructions for the operation, adjustment, lubrication, and other maintenance of the equipment including a lubrication chart.

C. **Drawings:**

1. Supplement product data with drawings as necessary to clearly illustrate:

    a. Relations of component parts of equipment and systems.
    b. Control and flow diagrams.

2. Coordinate drawings with information in Project Record Documents to assure correct illustration of complete installation.

D. **Written text, as required to supplement product data for the particular installation:**

1. Organize in a consistent format under separate headings for different procedures.
2. Provide a logical sequence of instructions for each procedure.

E. **Copy of each warranty, bond and service contract issued:** Provide information sheet for OWNER's personnel.

1. Proper procedures in the event of failure.
2. Instances which might affect the validity of warranties or bonds.

F. The manuals must be approved by the OWNER before final payment on the equipment is made.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

- END OF SECTION -

SECTION 01740
CONSTRUCTION PROGRESS PHOTOS

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. CONTRACTOR is responsible for the preparation, submittal and maintenance of digital construction progress photos.

B. Construction photographs provided by CONTRACTOR shall be in the form of digital files.

1.2 Related Sections

1. Section 01312 – Project Meetings

PART 2 – PRODUCTS

2.1 DESCRIPTION

A. Images must be created using only digital photographic equipment. Camera should be capable of utilizing a moderate wide-angle lens system and have electronic flash capable of properly illuminating a large interior space. The digital camera must have a sensor capacity of at least 6.1 megapixels and produce original uncompressed JPEG format image files that open to display at dimensions which exceed 20x30 inches, at a minimum of 72 dpi (1500 x 2200 pixels) resolution. The camera shall automatically imprint the date and time the photo is taken into one corner of the image. Digital images shall be saved in JPEG format and properly labeled.

B. Digital copies shall be provided for OWNER and ENGINEER by CONTRACTOR at each weekly progress meeting.

C. Saved images shall include detailed photograph description along with month, day, and year and separated by treatment process.

PART 3 – EXECUTION (NOT USED)

- END OF SECTION -

SECTION 02084
UNDERGROUND PRECAST CONCRETE UTILITY STRUCTURES

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall furnish and install structural pre-cast concrete work in accordance with the Contract Documents.

B. This Section covers the design, fabrication, delivery and installation of all pre-cast concrete units, including connections, complete, in place, as shown and specified.

C. **Related Sections:**

1. Section 02100 – Site Preparation
2. Section 02200 – Earthwork
3. Section 02318 – Trenching

1.2 CODES AND STANDARDS

A. **Codes:** All codes, as referenced herein, are specified in Section 01090 - Reference Standards.

B. **Referenced Documents:**

1. *ASTM Standards*:

ASTM A 82	Specification for Steel Wire, Plain, for Concrete Reinforcement
ASTM A 184	Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A 185	Specification for Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement
ASTM A 496	Specification for Steel Wire, Deformed, for Concrete Reinforcement
ASTM A 497	Specification for Welded Deformed Steel Wire Fabric for Concrete Reinforcement
ASTM A 615	Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A 616	Specification for Rail-Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A 617	Specification for Axle-Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A 706	Specification for Low-Alloy Steel Deformed Bars for Concrete Reinforcement
ASTM C 31	Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C 33	Specification for Concrete Aggregates

ASTM C 39	Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C 42	Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C 94	Specification for Ready-Mixed Concrete
ASTM C 150	Specification for Portland Cement
ASTM C 192	Practice for Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 231	Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	Specification for Air-Entraining Admixtures for Concrete
ASTM C 330	Specification for Lightweight Aggregates for Structural Concrete
ASTM C 478	Specification for Precast Reinforcement Concrete Manhole Sections
ASTM C 494	Test Method for Shear Fatigue of Sandwich Core Materials
ASTM C 595	Specification for Blended Hydraulic Cements
ASTM C 618	Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C 857	Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures

2. *American Concrete Institute Standards:*

ACI 318	Building Code Requirements for Reinforced Concrete

3. *American Welding Society Standards:*

AWS-D1.4	Structural Welding Code Reinforcing Steel

1.3 SUBMITTALS

A. Submittals shall be made in accordance with Section 01300 - Submittals.

B. **Shop Drawings:**

1. Shop drawings shall show structure dimensions and orientation and location of all applicable inflow and outflow penetrations, access hatches, and conduit sleeves.
2. Shop drawings shall include design structural calculations, assuming the applicable seismic zone, that are stamped and signed by a Professional Engineer registered in Arizona and shall be approved by the ENGINEER.
3. Shop drawings shall indicate pre-cast unit identification marks, location of units in the WORK, elevations, fabrication details, joint details, reinforcement, connections, dimensions, interface with adjacent members, and special handling instructions in sufficient detail to cover manufacture, handling and erection. Shop drawings shall include erection drawings.

C. **Test Reports:** Tests for compressive strength of concrete shall be performed by the factory. Copies of test reports including all test data and all test results shall be submitted.

D. **Certificates of Compliance:** Certificates of compliance shall be submitted attesting that materials and products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. **General Requirements:** Design members under direct supervision of a Professional Engineer experienced in design of pre-cast concrete units, registered in the State of Arizona and conforming to requirements of this specification.

1. Manufacture, Transportation and Installation: The Manufacturer shall specialize in providing pre-cast products and services normally associated with pre-cast concrete construction with high quality finishes similar to that indicated on drawings.

1.5 DELIVERY, STORAGE AND HANDLING

A. **General:** Pre-cast members shall be handled to position consistent with their shape and design; they shall be lifted and supported from design incorporated support points and provided with strong backs and other devices as required. Lifting or handling equipment shall be capable of maintaining units during manufacture, storage, transportation, erection, and in position for fastening.

B. Blocking and supports, lateral restraints and protective materials during transport and storage shall be clean, non-staining, without causing harm to exposed surfaces, including temporary support to prevent bowing and warping. Lateral restraints shall be provided to prevent undesirable horizontal movement. Edges and exposed faces of members shall be protected to prevent straining, chipping, or spalling of concrete.

C. Units shall be marked with date of production and final position in structure in location not visible after erection.

D. Pre-cast units shall be stored off the ground in a manner to prevent warpage and they shall be protected from weather, marring, and overload.

E. **Stainless Steel Hardware:** Stainless steel hardware shall be transported, handled, stored, and protected in wood crates.

PART 2 – PRODUCTS

2.1 MATERIALS

A. **Cement:** ASTM C 150 or ASTM C 595.

B. **Aggregates:** ASTM C 33 and ASTM C 330, except that the requirements for grading shall not apply.

C. **Admixtures:** May be used provided such admixtures are not injurious to other products used in the concrete.

D. **Chemical Admixtures:** ASTM C 494

E. **Fly Ash and Pozzolanic Admixture:** ASTM C 618

F. **Air-Entraining Admixtures:** ASTM C 260, shall be used when there is a risk that the concretemay be exposed to freeze-thaw cycles. The concrete mixture shall contain 5.5 ± 1.5% air by volume as determined by Test Method ASTM C 231.

G. **Water:** Used for curing, washing, aggregate, or mixing concrete shall be clean and free ofinjurious amounts of oil, acids, alkalis, salts, organic materials, or other substances that may be incompatible with concrete or steel.

H. **Steel Reinforcement:**

1.	Wire	ASTM A 82 or ASTM A 496
2.	Wire Fabric	ASTM A 185 or ASTM A 497
3.	Bars	ASTM A 184, ASTM A 615, ASTM A 616, ASTM A 617 or ASTM A 706

2.2 DESIGN REQUIREMENTS

A. **Design Method:** The elastic method of structural design or the ultimate strength method of reinforced concrete design as outlined in ACI 318 shall be used to design the concrete sections, including the reinforcement required, when the structure is subjected to the loading conditions covered in Practice C 857.

B. **Access Openings:** The structural design shall take into consideration the number, placement and size of access openings.

C. **Floors:** The minimum floor thickness resulting from slope shall be considered as nominal floor thickness in the structure.

D. **Terminators, Knockouts and Sumps:** Duct terminators, knockouts and sumps shall be designed to carry the loads imposed upon them. The basic structure shall be designed to carry all imposed loads with knockouts removed.

E. **Placement of Reinforcement:** The design concrete cover for reinforcing bars, mats or fabric shall not be less than ¾-inch (19 mm) subject to the requirements of Section 2.2.

F. **Concrete Strength:** The minimum specified compressive strength for design shall be 3000 psi (21 MPa) at 28 days of age. Compressive-strength tests should be made in accordance with Practices C 31 and C 192 and Test Methods C 39 and C 42.

G. **Joints:** Joints in sectional precast concrete structure shall be designed so as to be self-aligning when assembling sections of the structure.

1. The manufacture shall provide a single joint design on all units of the same size and type to ensure interchangeability.

H. **Lifting Devices:** Design of embedded lifting devices shall conform to requirements as specified in 8.4 under Special Loading Considerations of Practice ASTM C 890.

I. **Pickup Points and Boxouts:** Pickup points, boxouts and inserts on panel faces and surfaces to be exposed are prohibited except as approved.

J. **Traffic Loads:** Structure and access hatches shall be designed for HS-20-44 traffic wheel loads per AASHTO as last revised, including a 30% impact factor.

2.3 MANUFACTURE

A. **Forms:** Forms shall be accurately constructed and strong enough to maintain the structure's dimensions within the tolerances given in Section 2.4. Forms should be constructed in such a manner as to minimize the seepage of water. All casting surfaces shall be smooth nonporous material.

B. **Cleaning and Oiling:** Forms shall be cleaned before each use. New forms shall be free of paint or other protective coatings that might cling to the surface of the structure. Releasing agents applied to the form to aid in breaking the bond between the form and the concrete shall not be injurious to the concrete.

C. **Reinforcement:** Steel reinforcement shall conform to the requirements of this specification and shall be securely positioned in the form to maintain design concrete cover given in Section 2.2 during concrete placement. All chairs, bolsters, braces and spacers in contact with form and reinforcing rod shall be of material that will not deteriorate.

D. **Mixture:** The aggregates shall be sized, graded, proportioned and thoroughly mixed in a batch mixer with proportions of cement and water as will produce a homogeneous concrete having the required specified compressive strength. If Ready-Mix concrete is used, it shall be in accordance with Specification C 94.

E. **Concrete Placement:** Concrete shall be deposited as nearly as practicable in its final position. Concrete shall be placed in the form at a rate such that the concrete is plastic at all times and flows readily into all parts of the form and around all reinforcement steel and embedded fixtures without segregation of materials. Concrete that has partially hardened or has been contaminated by foreign material shall not be deposited in the form.

F. **Curing:** Structures shall be cured by an accepted industry method that will develop the required 28-day compressive strength without affecting the long-term durability of the concrete.

2.4 PERMISSIBILE VARIATIONS

A. **Dimensional Tolerances:** The length, width, height or diameter measurements of the structure when measured on the inside surface shall not deviate from the design dimensions more than the following:

Dimension	Tolerance
0 to 5-feet (0 to 1.5 m)	± ¼-inch (± 6 mm)
5 to 10-feet (1.5 to 3.0 m)	± ⅜-inch (± 10 mm)
10 to 20-feet (3.0 to 6.1 m)	± ½-inch (± 13 mm)
20-feet (6.1 m) and over	as agreed upon between manufacturer and purchaser

B. **Squareness Tolerance:** The inside of the precast concrete component shall be square as determined by diagonal measurements. The difference between such measurements shall not exceed the following:

Measured Length	Allowable Difference
0 to 10-feet (0 to 3.0 m)	± ½-inch (± 13 mm)
10 to 20-feet (3.0 to 6.1 m)	± ¾-inch (± 19 mm)
20-feet (6.1 m) and over	as agreed upon between manufacturer and purchaser

C. **Joint Surfaces:** The inside joint seam gap between two sections placed together without a joint sealant shall not exceed ⅜-inch (9.5 mm).

D. **Insert Location:** Insert locations for attachments in each component shall not deviate individually or cumulatively more than ± ⅛-inch (3.18 mm) from dimensions on specification drawings.

E. **Reinforcement Location:** With reference to thickness of wall or slab, reinforcement shall be within ± ¼-inch (6.3 mm) of the design location, but in no case shall the cover be less than ¾-inch (19 mm. The reinforcement spacing shall not vary more than one tenth of the designed bar spacing nor exceed 1½-inch (38 mm) in variation, except for welded wire mesh which shall conform to Specifications A 185 or A 497.

F. **Slab and Wall Thickness:** The slab and wall thickness shall not be less than that shown in the design by more than 5% or 3/16-inch (4.8 mm), whichever is greater. A thickness greater than that required in the design shall not be a cause for rejection.

2.5. REPAIRS

A. Precast concrete structures may be repaired. Repairs shall be performed by the manufacturer, in such a manner as to ensure that the repaired structure conforms to the requirements of this specification.

2.6 INSPECTION

A. The quality of material, process of manufacture, and the finished structure shall be subject to inspection at anytime by the purchaser or his representative.

2.7 REJECTION

A. Precast concrete structures or sections of structures shall be subject to rejection upon failure to conform to any specified requirements contained herein, or if any of the following imperfections occur:

1. Defects that indicate any imperfect concrete mixing and molding, or
2. Surface defects indicated by honeycombed or open-texture and damaged areas where such defects would affect the structural adequacy.

2.8 CERTIFICATION

A. At the request of the purchaser, the manufacturer shall, prior to the actual delivery of a structure, furnish a statement giving the source and type of cement, the source and specific gravities of the aggregates, the concrete mix proportions, strength, type, amount, and name of admixtures and mill certificates for the reinforcement steel used in manufacture.

2.9 MARKING

A. The weight shall be marked on the outside of each component section.

B. The purchaser may in his order request additional information to be marked on the component section.

C. The method of marking shall be agreed upon between the purchaser and the supplier prior to ordering.

PART 3 – EXECUTION

3.1 INSTALLATION

A. **Erection:**

1. The units shall be erected in accordance with approved shop/erection drawings without damage to shape or finish or adjacent work. Unless otherwise shown, members shall be erected level and plumb within allowable tolerances.

2. The CONTRACTOR shall align and maintain uniform horizontal joints as erection progresses, provide approved shims and wedges as required, and when members required adjustment beyond design or tolerance criteria, discontinue affected work. Units shall be secured in place and field welds, scratches and otherwise damaged steel surfaces shall be touched up.

3. Pickup points, boxouts, inserts and bearing surfaces shown shall be grouted with non-shrink grout in accordance with Section 03315 - Grout. The color and texture of concrete surfaces of adjacent areas shall be finished to match in the same plane.

3.2 CLEANING

A. Not sooner than 72 hours after joints are sealed, faces and other exposed surfaces of pre-cast units shall be cleaned using a cleaning detergent recommended by the sealer manufacturer.

B. Units shall be cleaned when temperature and humidity conditions are such that surfaces dry rapidly (e.g., 70 degrees Fahrenheit and rising, 50% RH or less).

C. Discolorations which cannot be removed by these procedures shall be considered defective work, and repaired or replaced as directed by ENGINEER.

3.3 PROTECTION

A. Adjacent surfaces shall be protected from damage during sealing and cleaning operations and against damage, disfiguration or discoloration from subsequent operations. Noncombustible shielding shall be used during welding operations.

- END OF SECTION -

SECTION 02085
FRAMES, GRATES, RINGS, AND COVERS

PART 1 - GENERAL

1.1 REQUIREMENTS

A. Iron castings for manhole frames and covers, inlet frames and grates, catch basin frames and grates, meter vault frames and covers, adjustment rings, and extensions.

B. Ring grates.

1.2 REFERENCES

A. **Commercial Standards**

AASHTO	American Association of State Highway and Transportation Officials Standard Specification for Highway Bridges
ASTM A 48	Standard Specification for Gray Iron Castings
ASTM A 615	Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
AWS - D 12.1	Welding Reinforcing Steel.

1.4 SUBMITTALS

A. Submittals shall be furnished in accordance with Section 01300 - Submittals.

B. Submit copies of manufacturer's specifications, load tables, dimension diagrams, anchor details, and installation instructions.

C. Submit shop drawings for fabrication and installation of casting assemblies that are not included in Drawings or standard City of Santa Paula details. Include plans, elevations, sections and connection details. Show anchorage and accessory items. Include setting drawings for location and installation of castings and anchorage devices.

PART 2 – PRODUCTS

2.1 CASTINGS

A. Use castings for frames, grates, rings and covers conforming to ASTM A 48, Class 35B. Provide locking covers if indicated on Drawings.

B. Use clean castings capable of withstanding application of AASHTO M306- 40,000 pound proof loading without detrimental permanent deformation.

C. Fabricate castings to conform to shapes, dimensions, and with wording or logos shown on Drawings. Standard dimensions for manhole covers are 32 inches in diameter.

D. Castings shall be tough, close-grained gray iron, sound, smooth, clean, free from blisters, blowholes, shrinkage, cold shuts, and all defects.

E. Cast iron. Castings shall be tough, close-grained gray iron, sound, smooth, clean, free from blisters, blowholes, shrinkage, cold shuts, and all defects, and shall conform to ASTM A48, Class 30B. Plane or grind bearing surfaces to ensure flat, true surfaces.

F. Bolt-down covers shall be used on all manholes within the double perimeter security fence and shall have either six 3/8-inch or four 1/2-inch-diameter by 1-1/2-inch-long capscrews with washers.

G. Capscrews and washers shall be Type 316 stainless steel conforming to ASTM Al 93. Countersink bolt holes in cover so that the top of the capscrews are below the top plane of the cover. Frames for bolt-down covers shall be supplied with four 3/4-inch-diameter Type 316 stainless steel anchor bolts, nuts, and washer as detailed on the Drawings.

H. Nominal inside opening of the frame shall be 24 inches. Provide a blind pick hole or lifting lug in the cover. Do not provide lifting rings or vent holes in covers unless specifically required.

2.2 BEARING SURFACES

A. Machine bearing surfaces between covers or grates and their respective frames so that even bearing is provided for position in which casting may be seated in frame.

2.3 SPECIAL FRAMES AND COVERS

A. Where indicated on Drawings, provide watertight manhole frames and covers with minimum of four bolts and gasket designed to seal cover to frame. Supply approved watertight manhole covers and frames.

B. Where shown on Drawing, provide manhole frames and covers with 48 inch diameter clear opening, with inner cover for 22 inch diameter clear opening. Provide approved inner cover with pattern shown on Drawings.

2.4 FINISH

A. Unless otherwise specified, uncoated coat iron.

2.5 FABRICATED RING GRATES

A. Fabricate ring grates from reinforcing steel conforming to ASTM A 615.

B. Conform to welds connecting bars to AWS D 12.1.

2.6 ADJUSTMENT RINGS FOR ASPHALT OVERLAYS

A. Use castings conforming Section 2.01.

B. One piece casting with dimensions to fit frame and cover.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install castings according to approved shop drawings, instructions in related specifications, and applicable directions from manufacturer's printed materials.

B. Set castings accurately at required locations to proper alignment and elevation. Keep castings plumb, level, true, and free of rack. Measure location accurately from established lines and grades. Brace or anchor frames temporarily in form work until permanently set.

C. Fabricate ring grates in accordance with City of Santa Paula standard detail, "Ring Grate for Open End of 18 Inch to 72 Inch Stubs to Ditch". Set in mortar in mouth of pipe bell.

D. Install adjustment rings in existing frames with clean bearing surfaces that are free from rocking.

-END OF SECTION-

SECTION 02100
SITE PREPARATION

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. The WORK of this Section as defined in the Contract includes all work necessary to satisfactorily prepare the site as shown on the accepted drawings and as specified herein. Following this preparation, the site shall be in such a condition as to easily continue with the next operation whether it be excavating, backfilling, or any other operations that are a part of the project. Site preparation includes clearing, grubbing, grading, tree and shrub removal, native grass stripping and removing and disposing of all debris within the limits of the project and such other areas as may be indicated on the plans or required work, except such objects as are designated to remain or are to be removed in accordance with the plans. This work shall also include the preservation from injury or defacement of all vegetation and objects designated to remain.

B. **Related Sections:**

1. Section 01040 – Coordination
2. Section 01505 – Mobilization
3. Section 01530 – Protection of Existing Facilities
4. Section 01550 – Site Access and Storage
5. Section 01560 – Temporary Environmental Controls
6. Section 01563 – Dust Control
7. Section 01565 – Erosion and Sediment Controls
8. Section 01722 – Field Engineering
9. Section 02200 – Earthwork

C. **Soils Report:** This work shall conform to the requirements of the latest Geotechnical Evaluation and or Soils Report.

1.2 SUBMITTALS

A. Submittals shall be made in accordance with Section 01300 - Submittals.

B. **Shop Drawings:** Submit clearing limits, staging, and site access plans and limits.

1.3 SITE SURVEY AND LAYOUT

A. The CONTRACTOR shall establish construction, and clearing limits by providing the initial site survey and field staking. The initial staking will include property line limits, casements and access points and structure locations with 100 ft offsets. The OWNER shall provide the contractor the survey data for the project to include the survey control points, hubs, etc and benchmarks for the site. The contractor shall layout required construction staking as defined in Section 01722 – Field Engineering.

1.4 PERMITS

A. Verify all required permits have been secured for this work. Comply with applicable local Air Pollution Control requirements. In the absence of specific ordinances, periodic watering shall be done to control dust throughout the work. Make all necessary arrangements for water required for this work.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION

3.1 PRIMARY SITE ACCESS

A. The CONTRACTOR shall provide clearing, grubbing, and stripping as defined in the contract.

B. The CONTRACTOR shall develop any necessary access to the Site, including access entrance barriers to prohibit entry of unauthorized persons as defined in the Contract. The contractor shall provide at the project site access barriers to prohibit entry of unauthorized persons as defined in the Contract.

C. Adequately support existing structures, sidewalks, slabs, pavements, utilities, and other facilities that may be affected by the proposed construction as defined in the Contract.

D. Utility Interference: Where existing utilities interfere with the WORK, notify the utility owner before proceeding in accordance with the General Conditions.

3.2 CLEARING, GRUBBING AND STRIPPING

A. The CONTRACTOR shall perform this work as defined in the Geotechnical Evaluation and or Soils Report.

B. Construction areas shall be cleared of grass and weeds to at least a depth of 1 inch and cleared of structures, pavement, sidewalks, concrete or masonry debris, trees, logs, upturned stumps, loose boulders, and any other objectionable material of any kind which would interfere with the performance or completion of the WORK, create a hazard to safety, or impair the subsequent usefulness of the WORK, or obstruct its operation. Trees and other natural vegetation outside the actual lines of construction shall be protected from damage during construction.

C. Within the limits of clearing, the areas below the natural ground surface shall be grubbed to a depth necessary to remove all stumps, roots, buried logs and all other objectionable material. Septic tanks, drain fields, and connection lines and any other underground structures, debris or waste shall be removed if found on the Site. All objectionable material from the clearing and grubbing process shall be removed from the Site and wasted in approved safe locations.

3.3 OVEREXCAVATION, REGRADING AND BACKFILL UNDER FILL AREAS

A. All grading and excavation shall conform to the requirements of the Geotechnical Evaluation and or Soils Report.

3.4 EXISTING UTILITY SERVICES

A. At start of work, CONTRACTOR shall locate and identify all utility services located within the construction limits (both underground and overhead). Utilize Blue Stake services and private location services as required, including potholing as may be necessary.

B. CONTRACTOR shall disconnect or reroute all existing services, where such services will be affected by construction operations. Comply with all instructions issued during the pre-construction conference regarding coordination, advance notice, emergency repairs, etc.

C. All disconnections or terminations shall be performed in safe manner, in accordance with applicable codes and regulations. Provide any disconnects switches, valves, plugs, tees, etc., as required for the various locations.

- END OF SECTION -

SECTION 02200
EARTHWORK

PART 1 - GENERAL

1.1 THE REQUIREMENT

A. Perform all earthwork indicated and required for construction of the WORK, complete and operable in accordance with the Contract Documents and the latest Geotechnical Evaluation and or Soils Report.

B. **Related Sections:**

1. Section 01040 – Coordination
2. Section 01530 – Protection of Existing Facilities
3. Section 01550 – Site Access and Storage
4. Section 01560 – Temporary Environmental Controls
5. Section 01563 – Dust Control
6. Section 01565 – Erosion and Sediment Controls
7. Section 01722 – Field Engineering
8. Section 02084 – Underground Precast Concrete Utility Structures
9. Section 02140 – Dewatering
10. Section 02318 – Trenching
11. Section 02537 – Sanitary Sewer Precast Lift Station

1.2 SUBMITTALS

A. Submittals shall be made in accordance with Section 01300 - Submittals.

1. Excavation Plan and stock pile storage sites.
2. Backfill Plan

PART 2 - PRODUCTS

2.1 SUITABLE FILL AND BACKFILL MATERIAL REQUIREMENTS

A. **General:** All excavation or backfill shall conform to the requirements of the Geotechnical Engineer. Fill, backfill, and embankment materials shall be suitable selected or processed clean, fine earth, rock, or sand, free from grass, roots, brush, or other vegetation and approved by the Geotechnical Engineer.

B. Fill and backfill materials to be placed within 6 inches of any structure or pipe shall be free of rocks or unbroken masses of earth materials having a maximum dimension larger than 3 inches.

C. **Suitable Materials:** Materials not defined as unsuitable in the following sections are defined as suitable materials and may be used in fills, backfilling and embankment construction subject to the indicated limitations. In addition, when acceptable to the ENGINEER, some of the material listed as unsuitable may be used when thoroughly mixed with suitable material to form a stable composite.

D. Suitable materials may be obtained from on-site excavations, or may be processed on-site materials. If the Geotechnical Engineer determines that excavated material is not suitable then additional compensation may be allowed on site processing or for import materials.

E. The following types of suitable materials are defined, unless otherwise specified in the project Geotechnical Evaluation and or Soils Report.

1. Type A: Native soil excavated from the site after the site is stripped in accordance with Section 02100 – Site Preparation. This soil must be approved by the Geotechnical Engineer.
2. Type B (sand backfill): Sand with 100% passing a $^{3}/_{8}$-inch sieve, at least 90% passing a Number 4-sieve, and a sand equivalent value not less than 30.
3. Type C (crushed rock): Crushed rock shall be imported material that consists of durable rock and gravel that is free of deleterious material and free from slaking or decomposition under the action of alternate wetting and drying. Crushed rock shall meet the following gradation requirements.

Sieve Size	Percentage Passing
1-inch	100
¾-inch	90 - 100
No. 4	0 - 10
No. 200	0 - 2

These materials should have a durability index of not less than 40.

4. Type D (pea gravel or chat backfill): Crushed rock or gravel with 100% passing a ½-inch sieve and not more than 10% passing a Number 4-sieve.
5. Type E (coarse drain rock): Crushed rock or gravel with a Durability Index of not less than 40 meeting the following gradation requirements:

Sieve Size	Percentage Passing
2-inch	100
1½-inch	90 - 100
1-Inch	20 - 55
¾-inch	0 - 15
No. 200	0 - 3

6. Type F (aggregate base): Crushed rock/gravel aggregate base material shall be in accordance with MAG Standard Specification Section 702. Crushed rock and gravel shall conform to the following gradation as listed in MAG Standard Specification 702, Table 702-1:

	Percentage by Weight Passing Sieve		
	Select Material		
Sieve Size (Square Openings)	Type A	Type B	Aggregate Base
3-inch	100	-	-
1½-inch	-	100	-
1 1/4-inch	-	-	100
No. 4	30-75	30-70	38-65
No. 8	20-60	20-60	25-60
No. 30	10-40	10-40	10-40
No. 200	0-12	0-12	3-12

7. Type G (topsoil): Shall not be used.
8. Type H (cement-treated backfill): Material which consists of Type E material, which has been cement-treated so that the cement content of the material is not less than 5% by weight when tested in accordance with ASTM D 2901 - Standard Test Method for Cement Content of Freshly Mixed Soil Cement. The ultimate compressive strength at 28 days shall be not less than 400 psi when tested in accordance with ASTM D 1633 - Standard Test Method for Compressive Strength of Molded Soil - Cement Cylinders.
9. Type I (trench plug): Low permeable fill material, a non-dispersible clay material having a minimum plasticity index of 10.

2.2 UNSUITABLE MATERIAL

A. **Unsuitable materials include the materials listed below:**

1. Soils defined as unsuitable in the Geotechnical Evaluation and or Soils Report or by the Geotechnical Engineer.
2. Soils which, when classified under ASTM D 2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System), fall in the Classifications of PT, OH, CH, MH or OL.
3. Soils, which cannot be compacted sufficiently to achieve the density specified for the intended use.
4. Materials that contain hazardous or designated waste materials including petroleum hydrocarbons, pesticides, heavy metals, and any material which may be classified as hazardous or toxic according to applicable regulations.
5. Soils that contain greater concentrations of chloride or sulfate ions, or have a soil resistivity or pH less than the existing on-site soils.
6. Topsoil, except as allowed below.

2.3 USE OF FILL, BACKFILL AND EMBANKMENT MATERIAL TYPES

A. The types of materials as designated herein for all required fill, backfill and embankment construction hereunder shall be used.

B. Where these Specifications conflict with the requirements of any local agency having jurisdiction or with the requirements of a pipe material manufacturer, the ENGINEER shall be immediately notified. In case of conflict between types of pipe embedment backfills, the agency-specified backfill material if that material provides a greater degree of structural support to the pipe shall be used. In case of conflict between types of trench or final backfill types, the agency-specified backfill material, if that material provides the greater in-place density after compaction shall be used.

C. **Fill and backfill types shall be used in accordance with the following provisions as approved by the Geotechnical Engineer:**

1. Embankment fills shall be constructed of Type A materials, as defined herein, or of primarily Type I mixed with lesser amounts of Type A through Type H materials.
2. Pipe zone backfill, as defined under Section 02318.
3. Aggregate base materials under pavements shall be Type F material constructed to the thicknesses indicated. For aggregate sub-base shall be Type H material.
4. Backfill around structures shall be Type I material or Types F or H where indicated on the plans.
5. Backfill materials beneath structures shall be defined by the Geotechnical Engineer or as follows:

    a. Drain rock materials under hydraulic structures or other water retaining structures with underdrain systems shall be Type C material or where shown.
    b. Under concrete hydraulic structures or other water retaining structures without underdrain systems, Types G or H materials shall be used. Undisturbed subgrade.

c. Under structures where groundwater must be removed to allow placement of concrete, Type E material shall be used. Before the Type E material is placed, filter fabric shall be placed over the exposed foundation.
d. Under all other structures, Type A or F materials shall be used.

7. Filter fabric, if not specified on the plans, shall be **Mirafi 140 N, Mirafi 700X** or ENGINEER approved equal.

2.4 MATERIALS TESTING

A. All soils testing of samples submitted will be done by a testing laboratory with the ENGINEER's approval and at no additional expense. At its discretion, the ENGINEER may request that samples for testing of any material used in the work be supplied.

B. Particle size analysis of soils and aggregates will be performed using ASTM D 422 - Standard Test Method for Particle-Size Analysis of Soils.

C. Determination of sand equivalent value will be performed using ASTM D 2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.

D. **Unified Soil Classification System:** References in this Section to soil classification types and standards shall have the meanings and definitions indicated in ASTM D 2487. ASTM D 2487 in the interpretation of soil classifications shall bind all applicable provisions.

PART 3 - EXECUTION

3.1 EXCAVATION - GENERAL

A. **General:** Except when specifically provided to the contrary, excavation shall include the removal of all materials of whatever nature encountered, including all obstructions of any nature that would interfere with the proper execution and completion of the WORK. The removal of said materials shall conform to the lines and grades indicated or ordered. Unless otherwise indicated, the entire construction site shall be stripped of all vegetation and debris, and such material shall be removed from the site prior to performing any excavation or placing any fill. All supports and shoring that may be required for the sides of the excavations shall be furnished, placed and maintained. Excavations shall be sloped or otherwise supported in a safe manner in accordance with applicable State and OSHA safety requirements and the requirements of OSHA Safety and Health Standards for Construction (29CFR1926).

B. **Removal and Exclusion of Water:** Remove and exclude water, including stormwater, groundwater, irrigation water and wastewater, from all excavations as defined in the contract.

3.2 STRUCTURE, ROADWAY, AND EMBANKMENT EXCAVATION

A. **Excavation Beneath Structures and Embankments**: Except where otherwise indicated for a particular structure, excavation shall be carried to the grade of the bottom of the footing or slab and prepared in accordance with the Geotechnical Evaluation and or Soils Report.

B. Excavation Beneath Paved Areas: Excavation under areas to be paved shall extend to the bottom of the aggregate base and prepared in accordance with the Geotechnical Evaluation and or Soils Report.

3.3 PIPELINE AND UTILITY TRENCH EXCAVATION

A. See Section 02318.

3.4 OVER-EXCAVATION NOT ORDERED OR INDICATED

A. Any over-excavation carried below the grade ordered or indicated, shall be backfilled and compacted to the required grade with the indicated material, in accordance with the Geotechnical Engineer's requirements.

3.5 DISPOSAL OF EXCESS EXCAVATED MATERIAL

A. Obtain OWNER approvals for disposal of excess excavated material in a designated wasting area, as defined in the contract.

3.6 BACKFILL - GENERAL

A. Backfill shall not be dropped directly upon any structure or pipe. Backfill shall not be placed around or upon any structure until the concrete has attained sufficient strength to withstand the loads imposed.

B. Except for drainrock materials being placed in over-excavated areas or trenches, backfill shall be placed after all water is removed from the excavation and the trench sidewalls and bottom have been dried to moisture content suitable for compaction.

C. Immediately prior to placement of backfill materials, the bottoms and sidewalls of trenches and structure excavations shall have all loose sloughing, or caving soil and rock materials removed. Trench sidewalls shall consist of excavated surfaces that are in a relatively undisturbed condition before placement of backfill materials.

3.7 PLACING AND SPREADING OF BACKFILL MATERIALS

A. Backfill materials shall be placed and spread evenly in layers. When compaction is achieved using mechanical equipment, the layers shall be evenly spread so that when each layer compacted shall not exceed 6 inches in thickness. The compaction lift depth may be adjusted at the direction of the Geotechnical Engineer.

B. During spreading, each layer shall be thoroughly mixed as necessary to promote uniformity of material in each layer. Pipe zone backfill materials shall be manually spread around the pipe so when compacted the pipe zone backfill will provide uniform bearing and side support.

C. Backfill should be compacted within a water content range of 3 percent below to 3 percent above optimum.

3.8 COMPACTION OF FILL, BACKFILL AND EMBANKMENT MATERIALS

A. Each layer of Types A, B, F and G, backfill materials as defined herein, where the material is graded such that at least 10% passes a No. 4-sieve, shall be mechanically compacted to the indicated percentage of density. Equipment that is consistently capable of achieving the required degree of compaction shall be used and each layer shall be compacted over its entire area while the material is at the required moisture content.

B. Each layer of Type C, D and E backfill materials shall be compacted by means of at least 2 passes from a flat plate vibratory compactor. When such materials are used for pipe zone backfill, vibratory compaction shall be used at the top of the pipe zone or at vertical intervals of 24 inches, whichever is the least distance from the sub-grade.

C. Flooding, pending or jetting shall not be permitted.

D. Equipment weighing more than 10,000 pounds shall not be used closer to walls than a horizontal distance equal to the depth of the fill at that time. Hand operated power compaction equipment shall be used where use of heavier equipment is impractical or restricted due to weight limitations. Exception: With the written approval of the Structural Engineer.

E. Backfill around and over pipelines that is mechanically compacted shall be compacted using light, hand operated, vibratory compactors and rollers. After completion of at least 2-feet of compacted backfill over the top of pipeline, compaction equipment weighing no more than 8,000 pounds may be used to complete the trench backfill.

F. **Compaction Requirements:** The following compaction test requirements shall be in accordance with ASTM D 1557 - Test Method for Laboratory Compaction Characteristics of Soils Using Modified Effort (56,000 ft - lbf/ft^3) (2,700 kN-m/m^3) for Type A, B, C, E, F and G materials and in accordance with ASTM D 4253 - Standard Test Method for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table, and D 4254 - Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density, for Type C, D, E and H materials. Where agency, utility company, or Geotechnical Evaluation and or Soils Report requirements govern, the highest compaction standards shall apply.

Location or Use of Fill	Percentage of Maximum Density
Final backfill, beneath paved areas or structures	95
Final backfill, not beneath paved areas or structures	90
Embankments and fills	90
Embankments and fills beneath paved areas or structures	90
Backfill beneath structures and hydraulic structures	95
Backfill and fill around structures on reservoir or structure roof	90
Topsoil (Type G material)	80
Aggregate base or sub-base (Type F or H material)	95

3.9 FILL AND EMBANKMENT CONSTRUCTION

A. The area where a fill or embankment is to be constructed shall be cleared, grubbed and stripped in accordance with Section 02100 - Site Preparation. Embankment and fill material shall be placed and spread evenly in approximately horizontal layers. Each layer shall be thoroughly mixed and moisture conditioned, as necessary. Unless otherwise approved by the ENGINEER, each layer shall not exceed 6 inches of compacted thickness.

B. Base keys shall be provided at the toes of all fill slopes more than 5-feet high. The keys shall be cut into underlying undisturbed soil. Keys shall be a minimum of 12-feet wide and 4-feet deep measured at the downslope side of the key. Keys shall be sloped back toward the fill slope at a gradient of no less than 2%.

C. When an embankment or fill is to be made and compacted against hillsides or slopes steeper than 4:1, the slopes shall be horizontally benched to key the embankment or fill to the underlying ground. A minimum of 12 inches normal to the slope shall be removed and re-compacted as the embankment or fill is brought up in layers. Material thus cut shall be re-compacted along with the new material. Hillside or fill slopes 4:1 or flatter shall be prepared in accordance with Paragraph A, above.

D. Where embankment or structure fills are constructed over pipelines, the first 4-feet of fill over the pipe shall be constructed using light placement and compaction equipment that does not damage the pipe. Heavy construction equipment shall maintain a minimum distance from the edge of the trench equal to the depth of the trench until at least 4-feet of fill over the pipe has been completed.

E. All permanent fill slopes shall be overbuilt by at least 1-foot and then cut to final grade to provide adequate compaction.

3.10 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.

2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings/structures and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 1 inch

2. Walks: Plus or minus 1 inch

3. Pavements: Plus or minus ½ inch

3.11 FIELD TESTING

A. **General:** All field soils testing shall be done by a testing laboratory as specified in the Contract Documents.

B. Where soil material is required to be compacted to a percentage of maximum density, the maximum density at optimum moisture content will be determined in accordance with Method C of ASTM D 1557. Where cohesionless, free draining soil material is required to be compacted to a percentage of relative density, the calculation of relative density will be determined in accordance with ASTM D 4253 and D 4254. Field density in-place tests will be performed in accordance with ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method, ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth), or by such other means acceptable to the ENGINEER.

C. In case the test of the fill or backfill show non-compliance with the required density, a remedy as may be required to insure compliance shall be accomplished. Subsequent testing to show compliance shall be performed by a testing laboratory.

D. Provide test trenches and excavations including excavation, trench support and groundwater removal for the ENGINEER's field soils testing operations. The trenches and excavations shall be provided at the locations and to the depths required by the ENGINEER.

- END OF SECTION -

SECTION 02318
TRENCHING

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. **Section Includes:** Trench excavation, fine grading, pipe bedding, backfilling, and compaction for the following, including requirements for ditch crossings:

1. Pipe and electrical conduits.
2. Manholes, valves, or other accessories.
3. Potable and non-potable water pipe appurtenances.

B. **Related Sections:**

1. Section 01530 – Protection of Existing Facilities
2. Section 01563 – Dust Control
3. Section 01565 – Erosion and Sediment Controls
4. Section 01700 – Project Closeout
5. Section 01722 – Field Engineering
6. Section 02084 – Underground Precast Concrete Utility Structures
7. Section 02100 – Site Preparation
8. Section 02200 – Earthwork

C. **Soils Report:** This work shall conform to the requirements of the latest Geotechnical Evaluation and or Soils Report.

1.2 REFERENCES

A. **American Society for Testing and Materials (ASTM):**

1. C 117 - Test Method for Material Finer than 75 Fm (No. 200) Sieve in Mineral Aggregates by Washing.
2. C 131 - Test Method for Resistance to Degradation of Small-Size Course Aggregate by Abrasion and Impact in the Los Angeles Machine.
3. C 136 - Test Method for Sieve Analysis of Fine and Course Aggregates.
4. D 1556 - Test Method for Density and Unit Weight of Soil in Place by the Sand Cone Method.
5. D 2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
6. D 4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.3 SUBMITTALS

A. Submittals shall be furnished in accordance with Section 01300 - Submittals.

B. **Products Data:** For all proposed bedding and backfill materials as defined in Section 02200 - Earthwork.

1. Material source.
2. Gradation.
3. Testing data.

PART 2 – PRODUCTS

2.1 MATERIALS

A. **General:**

1. The following types of suitable materials are defined, unless otherwise specified by the Geotechnical Evaluation and or Soils Report.
2. Provide material having maximum particle size not exceeding 4 inches and that is free of leaves, grass, roots, stumps, and other vegetable matter. Type A.
3. Materials derived from processing demolished or removed asphalt concrete are not acceptable.

B. **Aggregate Base Course:** As specified in Section 02200 – Earthwork, Type F.

C. **Gravel:** As specified in Section 02200 – Earthwork, Type C or D.

D. **Native Material:** As specified in Section 02200 – Earthwork, Type A.

E. **Sand:** As specified in Section 02200 – Earthwork, Type B.

F. **Select Material:** As specified in Section 02200 – Earthwork, Type H or I.

2.2 UNSUITABLE MATERIAL

A. **Unsuitable materials include the materials listed below:**

1. Soils as defined unsuitable in the Geotechnical Evaluation and or Soils Report or by the Geotechnical Engineer.
2. Soils which, when classified under ASTM D 2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System), fall in the Classifications of PT, OH, CH, MH or OL.
3. Soils, which cannot be compacted sufficiently to achieve the density specified for the intended use.
4. Materials that contain hazardous or designated waste materials including petroleum hydrocarbons, pesticides, heavy metals, and any material which may be classified as hazardous or toxic according to applicable regulations.
5. Soils that contain greater concentrations of chloride or sulfate ions, or have a soil resistivity or pH less than the existing on-site soils.
6. Topsoil, except as allowed below.

2.3 USE OF FILL, BACKFILL

B. Where these Specifications conflict with the requirements of any local agency having jurisdiction or with the requirements of a pipe material manufacturer, the ENGINEER shall be immediately notified. In case of conflict between types of pipe embedment backfills, the agency-specified backfill material if that material provides a greater degree of structural support to the pipe shall be used. In case of conflict between types of trench or final backfill types, the agency-specified backfill material, if that material provides the greater in-place density after compaction shall be used.

C. Fill and backfill types shall be used in accordance with the following provisions:

1. Pipe zone backfill shall consist of the following materials for each pipe material listed below.

a. Mortar coated pipe, concrete pipe and un-coated ductile iron pipe shall be provided Type C or D pipe bedding and embedment backfill material.

b. Coal tar enamel coated pipe, polyethylene encased pipe, tape wrapped pipe and other non-mortar coated pipe shall be backfilled with Type B bedding and embedment zone backfill material.
c. Plastic pipe shall be backfilled with Type B, C, or D bedding and embedment zone backfill material.
d. Where pipelines are installed on grades exceeding 4%, and where backfill materials are graded such that there is less than 10% passing a Number 4-sieve, trench plugs of Type H or I material shall be provided at maximum intervals of 200 feet unless indicated otherwise.

2. Allowable trench backfill materials for pipelines as defined under the MAG Standards and Specifications.

2.4 MATERIALS TESTING

A. As defined in Section 02200 - Earthwork

PART 3 – EXECUTION

3.1 PREPARATION

A. **General:**

1. All utility piping shall be field surveyed for location of pipe runs and joints prior to backfilling.
2. Before laying pipes or electrical conduits in fill, place fill and compact it to not less than 1 ft above top of pipe or conduit.
3. After placing and compacting fill, excavate through fill and fine grade as required in this Section.

B. **Protection:** Stabilize excavation as required by OSHA or local standards, whichever is more stringent.

3.2 EXCAVATION AND GRADING

A. **Exploratory Excavation:**

1. Excavate and expose buried points of connection to existing utilities where indicated on the Drawings. Excavation shall be performed prior to preparation of Shop Drawings for connections and before fabrication of pipe, and the data obtained shall be used in preparing Shop Drawings.
2. Data, including dates, locations excavated, and sketches, shall be submitted to the ENGINEER within one week of excavation.
3. Damage to utilities from excavation activities shall be repaired at the CONTRACTOR's expense.

B. **Trench Excavation:**

1. General Requirements:

a. If, because of soil conditions, safety requirements or other reasons, trench width at top of pipe is increased beyond width specified in the MAG Standards and Specifications, upgrade laying conditions or install stronger pipe designed in conformance with the appropriate pipe specification section for the increased trench width, without additional cost.

b. Pipe and Electrical Conduits:

1) Lay pipe or electrical conduits in open trench.
2) If bottom of excavation is found to consist of rock or any material that by reason of its

other material to a depth of not less than 4 inches below bottom of pipe and refill to grade with aggregate base course material or sand placed at uniform density, with minimum possible compaction, at no additional cost.

3) If bottom of excavation is found to consist of soft or unstable material which is incapable of properly supporting pipe, remove such material to a depth and for the length required, as determined by the ENGINEER, and then refill trench to grade with aggregate base course or sand, compacted to 90 percent of maximum density.

4) Where indicated on the Drawings, cradle pipe in concrete.

c. For Manholes, Valves, or Other Accessories:

1) Provide excavations sufficient to leave at least 12 inches clear between their outer surfaces and embankment or shoring which may be used to hold banks and protect them.

2) Do not backfill with earth under manholes, vaults, tanks, or valves.

3) Fill any unauthorized excess excavation below elevation indicated on the Drawings for foundation of any structure with sand, aggregate base material, bedding material, or concrete at no additional cost.

4) Backfilling of Manhole Excavation: Conform to backfilling requirements as specified for pipe and utility trench backfill in this Section.

d. Potable and Non-Potable Water Pipe Appurtenances:

1) Lay in trenches separate from those used for sewers.

2) Unless otherwise specified or indicated on the Drawings, lay in trenches having cover of not less than 3 feet below surface of ground and located at distance of not less than 6 feet from any parallel sewer trench, or as required by local requirements.

e. At Road Crossings or Existing Driveways:

1) Make provision for trench crossings at these points, either by means of backfills, tunnels, or temporary bridges.

C. **Trench Fine Grading:**

1. For Pipes 16 Inches in Nominal Diameter and Under:

a. Unless otherwise specified, accurately grade bottom of trench to provide uniform bearing and support for each section of pipe, on undisturbed soil at every point along pipe's entire length, except for portions of pipe where it is necessary to excavate for bells and for proper sealing of pipe joints.

2. For Pipe over 16 Inches in Diameter:

a. Overexcavate bottom of trench by at least 4 inches, or 1/12 outside diameter of pipe, whichever is greater.

b. Fill overcut with bedding material specified herein, and fine graded as specified above.

c. Place bedding material at uniform density, with minimum possible compaction.

d. Where trench excavation is below grade of bedding material, restore trench bottom to proper grade by backfilling and compacting backfill to 95 percent of maximum density, at no additional cost. Use bedding material as specified in this Section.

3. Bell or Coupling Holes:

a. Dig holes after trench bottom has been graded.
b. Provide holes of sufficient width to provide ample room for grouting, banding, or welding.
c. Excavate holes only as necessary in making joints and to ensure that pipe rests upon prepared trench bottom and not supported by any portion of the joint.

4. Depressions for Joints, Other than Bell and spigot:

a. Make in accordance with recommendations of joint manufacturer for particular joint used.

3.3 DISPOSAL OF EXCESS EXCAVATED MATERIAL

A. Obtain OWNER approvals for disposal of excess excavated material in designated wasting area, as defined in the contract.

3.4 BACKFILL - GENERAL

A. Backfill shall not be dropped directly upon any pipe. Backfill shall not be placed around or upon any structure until the concrete has attained sufficient strength to withstand the loads imposed.

B. Except for drainrock materials being placed in over-excavated areas or trenches, backfill shall be placed after all water is removed from the excavation and the trench sidewalls and bottom have been dried to moisture content suitable for compaction.

C. If a moveable trench shield is used during excavation, pipe installation and backfill operations, the shield shall be moved by lifting the shield free of the trench bottom or backfill and then moving the shield horizontally. No trench shields shall be dragged along the trench causing damage or displacement to the trench sidewalls, the pipe, or the bedding and backfill.

D. Immediately prior to placement of backfill materials, the bottoms and sidewalls of trenches and structure excavations shall have all loose sloughing, or caving soil and rock materials removed. Trench sidewalls shall consist of excavated surfaces that are in a relatively undisturbed condition before placement of backfill materials.

E. 3.5 PLACING AND SPREADING OF BACKFILL MATERIALS

A. During spreading, each layer shall be thoroughly mixed as necessary to promote uniformity of material in each layer. Pipe zone backfill materials shall be manually spread around the pipe so when compacted the pipe zone backfill will provide uniform bearing and side support.

B. Where the backfill material moisture content is below the optimum moisture content, water shall be added before or during spreading until the moisture content is between optimum and 3% over the optimum.

C. Where the backfill material moisture content is too high to permit the specified degree of compaction the material shall be dried until the moisture content is between optimum and 3% over the optimum.

3.6 COMPACTION OF FILL, BACKFILL AND EMBANKMENT MATERIALS

A. **Compaction Requirements:** Backfill compaction requirements shall be per the Geotechnical Evaluation and or Soils Report and per MAG Standards and Specifications.

3.7 PIPE AND UTILITY TRENCH BACKFILL

A. **Pipe Zone Backfill:**

1. The pipe zone is defined as that portion of the vertical trench cross-section lying between a plane below the bottom surface of the pipe and a plane at a point above the top surface of the pipe. The bedding is defined as that portion of pipe zone backfill material between the trench sub-grade and the bottom of the pipe. The embedment is defined as that portion of the pipe zone backfill material between the bedding and a level line.
2. After compacting the bedding, perform a final trim using a laser or approved method for establishing grade, such that each pipe section when first laid will be continually in contact with the bedding along the extreme bottom of the pipe. Excavation for pipe bells and welding shall be made as required.
3. The pipe zone shall be backfilled with the indicated backfill material. Care to prevent damage to the pipeline coating, cathodic bonds and the pipe itself during the installation and backfill operations shall be exercised.
4. If a moveable trench shield is used during backfill operations, the shield shall be lifted to a location above each layer of backfill material prior to compaction of the layer. The pipe or backfill shall not be displaced while the shield is being moved.

B. **Trench Zone Backfill:** After the pipe zone backfills have been placed, backfilling of the trench zone may proceed. The trench zone is defined as that portion of the vertical trench cross-section lying as indicated between a plane above the top surface of the pipe and a plane at a point, 18 inches below the finished surface grade, or if the trench is under pavement, 18 inches below the roadway sub-grade.

C. **Final Backfill:** Final backfill is all backfill in the trench cross-sectional area within 18 inches of finished grade, or if the trench is under pavement, all backfill within 18 inches of the roadway sub-grade.

3.8 FIELD QUALITY CONTROL

A. **Tests:**

1. Confirmation Tests:

a. CONTRACTOR's Responsibilities:

1) Accomplish specified compaction of trench backfill.
2) Control operations by confirmation tests to verify and confirm that compaction work complies, and is complying at all times, with requirements specified in this Section concerning compaction, control, and testing.
3) All field soils testing will be done by a testing laboratory as specified in the Contract Documents.
4) Copies of Confirmation Test Reports: Submit promptly to the ENGINEER.

b. Frequency of Confirmation Testing:

1) Perform testing not less than as follows:

a) For Trenches: At each test location include tests for each type or class of backfill from bedding to finish grade.
b) In Open Fields: Two every 1,000 linear feet.
c) Along Dirt or Gravel Road or off Traveled Right-of-way: Two every 500 linear feet.
d) Crossing Paved Roads: Two locations along each crossing.
e) Under Pavement Cuts or Within 2 Feet of Pavement Edges: one location every 400 linear feet.

2. Compliance Tests:

ENGINEER to verify that compaction is meeting requirements previously specified.

b. If Compaction Fails to Meet Specified Requirements: Perform remedial work by one of the following methods:

   1) Remove and replace backfill at proper density.
   2) Bring density up to specified level by other means acceptable to the ENGINEER.

c. Retesting:

   1) Costs of Retesting: Costs of retesting required to confirm and verify that remedial work has brought compaction within specified requirements shall be borne by the CONTRACTOR.
   2) CONTRACTOR's Confirmation Tests During Performance of Remedial Work:

      a) Performance: Perform tests in manner acceptable to the ENGINEER.
      b) Frequency: Double amount specified for initial confirmation tests.

3. Leak Testing Pipe:

   a. After Bedding the Pipe, CONTRACTOR Has the Following Option To:

      1) Leak-test pipe.
      2) Backfill to surface, at his own risk, before leak water-testing pipe.

   b. If pipe does not pass test, uncover pipe, locate leaks, repair and retest, repeating until pipe section under test passes.

- END OF SECTION -

SECTION 03100
CONCRETE FORMWORK

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. Furnish all materials for concrete formwork, bracing, shoring and supports and shall design and construct all falsework, all in accordance with the provisions of the Contract Documents.

1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. **Codes:** All codes, as referenced herein, as specified in Section 01090 - Reference Standards.

B. **Government Standards:**

PS 1	Construction and Industrial Plywood
PS 20	American Softwood Lumber Standard

C. **Commercial Standards:**

ACI 117	Standard Tolerances for Concrete Construction and Materials
ACI 347	Guide to Formwork for Concrete
ACI 350R	Environmental Engineering Concrete Structures

1.3 SUBMITTALS

A. Submittals shall be furnished in accordance with Section 01300 - Submittals.

B. **Submittals shall include the following:**

1. Proposed falsework showing general layout, sizes of members, anticipated stresses, grade of materials to be used in the falsework, means of protecting existing construction, which supports falsework, and typical soil conditions.
2. Form ties and all related accessories, including taper tie plugs, if taper ties are used.
3. Form gaskets.
4. Water stops
5. Joint location and pouring sequence.

1.4 QUALITY ASSURANCE

A. **Tolerances:** The variation from established grade or lines shall not exceed ¼-inch in 10 feet and there shall be no offsets or visible waviness in the finished surface. All other tolerances shall be within the tolerances of ACI 117 and ACI 350R.

B. **Qualifications of Formwork Manufacturers:** Use only forming systems manufactured by manufacturers having minimum 5 years experience, except as otherwise specified, or accepted in writing by the ENGINEER.

C. **Regulatory Requirements:** Install work of this Section in accordance with local, state, and federal

regulations.

PART 2 – PRODUCTS

2.1 GENERAL

A. Except as otherwise expressly accepted by the ENGINEER, all lumber brought on the job site for use as forms, shoring, or bracing shall be new material. All forms shall be smooth surface forms and shall be of the following materials:

1.	Walls	-	Steel or plywood panel
2.	Columns	-	Steel, plywood or fiber glass
3.	Roof and floor	-	Plywood
4.	All other work	-	Steel panels, plywood or tongue and groove lumber

2.2 FORM AND FALSEWORK MATERIALS

A. Materials for concrete forms, formwork and falsework shall conform to the following requirements:

1. Lumber shall be Douglas Fir or Southern Yellow Pine, construction grade or better, in conformance with U.S. Product Standard PS 20.
2. Plywood for concrete formwork shall be new, waterproof, synthetic resin bonded; exterior type Douglas Fir or Southern Yellow Pine plywood manufactured especially for concrete formwork and shall conform to the requirements of PS 1 for Concrete Forms, Class I, and shall be edge sealed.
3. Form materials shall be metal, wood, plywood or other approved material that will not adversely affect the concrete and will facilitate placement of concrete to the shape, form, line and grade shown. Metal forms shall be an approved type that will accomplish such results. Wood forms for surfaces to be painted shall be Medium Density Overlaid plywood, MDO Ext. Grade.

B. Unless otherwise shown, exterior corners in concrete members shall be provided with ¾-inch chamfers. Re-entrant corners in concrete members shall not have fillets unless otherwise shown.

C. Forms and falsework to support the roof and floor slabs shall be designed for the total dead load, plus a live load of 50 psf (minimum). The minimum design load for combined dead and live loads shall be 100 psf.

2.3 FORM TIES

A. Form ties shall be provided with a plastic cone or other suitable means for forming a conical hole to insure that the form tie may be broken off back of the face of the concrete. The maximum diameter of removable cones for rod ties, or of other removable form-tie fasteners having a circular cross-section, shall not exceed 1½ inches; and all such fasteners shall be such as to leave holes of regular shape for reaming. Form ties for water-retaining structures shall have integral waterstops. Integral waterstops shall tightly fit the form tie so that they cannot be moved from mid-point of the tie. Form ties shall be **Burke Penta-Tie System by The Burke Company; Richmond Snap-Tys by the Richmond Screw Anchor Company;** or ENGINEER approved equal.

B. Removable taper ties may be used when approved by the ENGINEER. A preformed neoprene or polyurethane tapered plug sized to seat at the center of the wall shall be inserted in the hole left by the removal of the taper tie. **Use Burke Taper-Tie System by The Burke Company; Taper-Ty by the Richmond Screw Anchor Company;** or ENGINEER approved equal.

PART 3 – EXECUTION

3.1 GENERAL

A. Forms to confine the concrete and shape it to the required lines shall be used wherever necessary. The CONTRACTOR shall assume full responsibility for the adequate design of all forms, and any forms, which are unsafe or inadequate in any respect, shall promptly be removed from the WORK and replaced at the CONTRACTOR's expense. Provide worker protection from protruding reinforcement bars in accordance with applicable safety codes. A sufficient number of forms of each kind shall be provided to permit the required rate of progress to be maintained. The design and inspection of concrete forms, falsework and shoring shall comply with applicable local, state and Federal regulations. Plumb and string lines shall be installed before concrete placement and shall be maintained during placement. Such lines shall be used by CONTRACTOR personnel and by the ENGINEER, shall be in sufficient number, and properly installed. During concrete placement, the CONTRACTOR shall continually monitor plumb and string line form positions and immediately correct deficiencies.

B. Concrete forms shall conform to the shape, lines, and dimensions of members as called for on the Contract Drawings, and shall be substantial, free from surface defects, and sufficiently tight to prevent leakage. Forms shall be properly braced or tied together to maintain their position and shape under a load of freshly placed concrete. If adequate foundation for shores cannot be secured, trussed supports shall be provided.

3.2 FORM DESIGN

A. All forms shall be true in every respect to the required shape and size, shall conform to the established alignment and grade, and shall be of sufficient strength and rigidity to maintain their position and shape under the loads and operations incident to placing and vibrating the concrete. Suitable and effective means shall be provided on all forms for holding adjacent edges and ends of panels and sections tightly together and in accurate alignment to prevent the formation of ridges, fins, offsets or similar surface defects in the finished concrete. Plywood, 5/8-inch and greater in thickness, may be fastened directly to studding if the studs are spaced close enough to prevent visible deflection marks in the concrete. The forms shall be tight to prevent the loss of water, cement and fines during placing and vibrating of the concrete. Specifically, the bottom of wall forms that rest on concrete footings or slabs shall be provided with a gasket to prevent loss of fines and paste during placement and vibration of concrete. Such gasket may be a 1 to 1½-inch diameter polyethylene rod held in position to the underside of the wall form. Adequate clean-out holes shall be provided at the bottom of each lift of forms. The size, number and location of such clean-outs shall be as acceptable to the ENGINEER. Whenever concrete cannot be placed from the top of a wall form in a manner that meets the requirements of the Contract Documents, form windows shall be provided in, the size and spacing needed to allow placement of concrete to the requirements of Section 03300 - Cast-in-Place Concrete. The size, number and location of such form windows shall be as acceptable to the ENGINEER.

3.3 CONSTRUCTION

A. **Vertical Surfaces:** All vertical surfaces of concrete members shall be formed, except where placement of the concrete against the ground is shown. Not less than 1-inch of concrete shall be added to the thickness of the concrete member as shown where concrete is permitted to be placed against trimmed ground in lieu of forms. Such permission will be granted only for members of comparatively limited height and where the

character of the ground is such that it can be trimmed to the required lines and will stand securely without caving or sloughing until the concrete has been placed.

B. **Construction Joints:** Concrete construction joints will not be permitted at locations other than those shown or specified, except as may be acceptable to the ENGINEER. When a second lift is placed on hardened concrete, special precautions shall be taken in the way of the number, location, and tightening of ties at the top of the old lift and bottom of the new to prevent any unsatisfactory affect whatsoever on the concrete. Pipe stubs and anchor bolts shall be set in the forms where required.

C. **Form Ties:**

1. Embedded Ties: Holes left by the removal of form tie cones shall be reamed with suitable toothed reamers to leave the surface of the holes clean and rough before being filled with mortar as specified for "Finish of Concrete Surfaces" in Section 03300 - Cast-in-Place Concrete. Wire ties for holding forms will not be permitted. No form-tying device or part thereof, other than metal, shall be left embedded in the concrete. Ties shall not be removed in such manner as to leave a hole extending through the interior of the concrete members. The use of snap-ties, which cause spalling of the concrete upon form stripping or tie removal, will not be permitted. If steel panel forms are used, rubber grommets shall be provided where the ties pass through the form in order to prevent loss of cement paste. Where metal rods extending through the concrete are used to support or to strengthen forms, the rods shall remain embedded and shall terminate not less than 1-inch back from the formed face or faces of the concrete.

2. Removable Ties: Where taper ties are approved for use, the larger end of the taper tie shall be on the wet side of walls in water retaining structures. After the taper tie is removed, the hole shall be thoroughly cleaned and roughened for bond. A precast neoprene or polyurethane tapered plug shall be located at the wall centerline. The hole shall be completely filled with non-shrink grout for water bearing and below-grade walls. The hole shall be completely filled with non-shrink or regular cement grout for above-grade walls, which are dry on both sides. Exposed faces of walls shall have the outer 2 inches of the exposed face filled with a cement grout, which shall match the color and texture of the surrounding wall surface or approved equal.

3.4 REUSE OF FORMS

A. Forms may be reused only if in good condition and only if acceptable to the ENGINEER. Light sanding between uses will be required wherever necessary to obtain uniform surface texture on all exposed concrete surfaces. Exposed concrete surfaces are defined as surfaces, which are permanently exposed to view. In the case of forms for the inside wall surfaces of hydraulic/water retaining structures, unused tie rod holes in forms shall be covered with metal caps or shall be filled by other methods acceptable to the ENGINEER.

3.5 REMOVAL OF FORMS

A. Careful procedures for the removal of forms shall be strictly followed, and this work shall be done with care to avoid injury to the concrete. No heavy loading on green concrete will be permitted. In the case of roof slabs and above-ground floor slabs, forms shall remain in place until test cylinders for the roof concrete attain a minimum compressive strength of 75% of the 28-day strength specified in Section 03300 - Cast-in-Place Concrete; provided, that no forms shall be disturbed or removed under an individual panel or unit before the concrete in the adjacent panel or unit has attained 75% of the specified 28-day strength and has been in place for a minimum of 7 days. The time required to establish said strength shall be as determined by the ENGINEER. The CONTRACTOR shall contract with a testing agency that will make several test cylinders for this purpose from concrete used in the first group of roof panels placed. If the time so determined is more than the 7-day minimum, then that time shall be used as the minimum length of time. Forms for all vertical

walls of waterholding structures shall remain in place at least 36 hours after the concrete has been placed; or, timeframe based upon pre-approved CONTRACTOR pour schedule. Forms for all parts of the WORK not specifically mentioned herein shall remain in place for periods of time as recommended in ACI 347.

3.6 MAINTENANCE OF FORMS

A. Forms shall be maintained at all times in good condition, particularly as to size, shape, strength, rigidity, tightness and smoothness of surface. Forms, when in place, shall conform to the established alignment and grades. Before concrete is placed, the forms shall be thoroughly cleaned. The form surfaces shall be treated with a nonstaining mineral oil or other lubricant acceptable to the ENGINEER. Any excess lubricant shall be satisfactorily removed before placing the concrete. Where field oiling of forms is required, the CONTRACTOR shall perform the oiling at least two weeks in advance of their use. Care shall be exercised to keep oil off the surfaces of steel reinforcement and other metal items to be embedded in concrete.

3.7 FALSEWORK

A. The CONTRACTOR shall be responsible for the design, engineering, construction, maintenance, and safety of all falsework, including staging, walkways, forms, ladders, and similar appurtenances, which shall equal or exceed the applicable requirements of the provisions of the OSHA Safety and Health Standards for Construction and the requirements specified herein.

B. All falsework shall be designed and constructed to provide the necessary rigidity and to support the loads. Falsework for the support of a superstructure shall be designed to support the loads that would be imposed if the entire superstructure were placed at one time.

C. Falsework shall be placed upon a solid footing, safe against undermining, and protected from softening. When the falsework is supported on timber piles, the maximum calculated pile loading shall not exceed 20 tons. When falsework is supported on any portion of the structure, which is already constructed, the load imposed by the falsework shall be spread, distributed and braced in such a way as to avoid any possibility of damage to the structure.

- END OF SECTION -

SECTION 03150
CONCRETE ACCESSORIES

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Provision of waterstops embedded in concrete and spanning control, expansion, and/or construction joints to create a continuous diaphragm to prevent fluid migration.

B. Provision of strip applied expanding waterstop, embedded in concrete and spanning pipe penetrations, to create a continuous diaphragm for prevention of fluid migration.

1.2 REFERENCES

A. **PVC Waterstop:**

1. Corps of Engineers: CRD-C 572-74
2. American Society for Testing Materials (ASTM)
3. Bureau of Reclamation: C-902
4. Canadian General Standards Board: 41-GP-35M Types 1 & 3

B. **Hydrophilic Waterstop:** American Society for Testing Materials (ASTM)

C. **Related Sections:**

1. Section 03100 – Concrete Formwork
2. Section 03290 – Joints in Concrete
3. Section 03300 – Cast-In-Place Concrete

1.3 SUBMITTALS

A. Submittals shall be furnished in accordance with Section 01300 – Submittals.

B. **Product Data:**

1. Polyvinyl chloride waterstop: data of complete physical properties.
2. Stripped applied waterstop: data of complete physical properties.

C. **Samples:**

1. Polyvinyl chloride waterstop.
2. Strip applied waterstop.

1.4 DELIVERY, STORAGE, AND HANDLING

A. PVC waterstops, Store waterstops under tarps to protect from oil, dirt, sunlight, and premature exposure to water.

B. **Strip applied waterstop:**

1. Protect waterstops from exposure to moisture that may cause premature waterstop expansion.
2. Store waterstops under cover to protect from oil, dirt, and sunlight.

PART 2 – PRODUCTS

2.1 PVC WATERSTOPS FOR JOINTS

A. Provide flexible PVC (polyvinyl chloride) waterstop as manufactured by Greenstreak, profile style number. Ribbed with Centerbulb. Model No 735,718,696 or equal.

B. The PVC waterstop shall be extruded from an elastomeric plastic material of which the basic resin is prime virgin polyvinyl chloride. The PVC compound shall not contain any scrapped or reclaimed material or pigment whatsoever.

C. **Performance Requirements as follows:**

Property	Test Method	Required Limits
Water absorption	ASTM D 570	0.15% max
Tear Resistance	ASTM D 624	200 lb/in (35 kN/m) min.
Ultimate Elongation	ASTM D 638	350% min.
Tensile Strength	ASTM D 638	2000 psi (13.78 Mpa) min.
Low Temperature Brittleness	ASTM D 746	No Failure @ -35° F (-37° C)
Stiffness in Flexure	ASTM D 747	600 psi (4.13 Mpa) min.
Specific Gravity	ASTM D 792	1.45 max.
Hardness, Shore A	ASTM D 2240	79 ±3
Tensile Strength after accelerated extraction	CRD-C 572	1850 psi (11.03 Mpa) min.
Elongation after accelerated extraction	CRD-C 572	300% min.
Effect of Alkalies after 7 days: Weight Change Hardness Change	CRD-C 572	 between -0.10% / +0.25% +/- 5 points

2.2 STRIP APPLIED WATERSTOP FOR PIPING & PENETRATIONS THROUGH THE TANK

A. Provide strip applied expanding waterstop comprised of bentonite clay, hydrophilic polymers, and butyl rubber. Product shall be SWELLSTOP, as supplied by Greenstreak, Inc. 3400 Tree Court Industrial Blvd., St. Louis, MO 63122, Phone: 800-325-9400, Fax: 800-551-5145. Or equal.

B. **Performance Requirements:**

Property	Test Method	Required Limits
Specific Gravity	ASTM D 71	1.55 +/- 5%
Penetration	ASTM D 217 @ 77° F	40 +/- 5 at 150 GTL
Volatile Matter	ASTM D-6	1% max.
Application Temperature Range		-10° to 125° F (-23° - 52° C)
Service Temperature Range		-30° to 180° F (-34° - 82° C)

2.3 STRIP APPLIED WATERSTOP FOR CONCRETE CAST AGAINST EXISTING CONCRETE STRUCTURES

A. Provide strip applied expanding waterstop comprised of modified chloropene rubber. Product shall be "HYDROTITE", as supplied by Greenstreak, Inc. 3400 Tree Court Industrial Blvd., St. Louis, MO 63122, Phone: 800-325-9400, Fax: 800-551-5145. Or equal.

B. The waterstop shall be a combination of chloroprene rubber and chloroprene rubber modified to impart hydrophilic properties.

C. The waterstop shall have a delay coating to inhibit initial expansion due to moisture present in fresh concrete.

D. Performance Requirements as follows:

1. Chloroprene Rubber:

Property	**Test Method**	**Required Limits**
Tensile Strength	ASTM D 412	1300 PSI min.
Ultimate Elongation	ASTM D 412	400% min.
Hardness (Shore A)	ASTM D 2240	50 +/- 5
Tear Resistance	ASTM D 624	100 lb/inch min.

2. Modified Chloroprene (Hydrophilic) Rubber:

Property	**Test Method**	**Required Limits**
Tensile Strength	ASTM D 412	350 PSI min.
Ultimate Elongation	ASTM D 412	600% min.
Hardness (Shore A)	ASTM D 2240	52 +/- 5
Tear Resistance	ASTM D 624	50 lb/inch
Expansion Ratio	Volumetric Change - Distilled Water @ 70° F	3 to 1 min.

2.4 ACCESSORIES

A. **PVC Waterstops:**

1. Provide factory made waterstop fabrications for all changes of direction, intersections, and transitions leaving only straight butt joint splices for the field.
2. Provide hog rings or grommets spaced at 12 inches on center along length of waterstop.
3. Provide Teflon coated thermostatically controlled waterstop splicing irons for field butt splices.

B. **Strip Applied Waterstops:**

1. Provide SWELLSTOP Primer Adhesive to continuously secure SWELLSTOP to concrete or equal.
2. Provide concrete nails as required to secure SWELLSTOP and HYDROTITE in vertical or overhead applications or equal.
3. On rough concrete surfaces apply LEAKMASTER to smooth surfaces and adhere to HYDROTITE.

PART 3 – EXECUTION

3.1 INSTALLATION

A. **PVC Waterstop:**

1. Refer to manufacturer installation recommendations.
2. Field butt splices shall be heat fused welded using a teflon covered thermostatically controlled waterstop splicing iron at approximately 380 degrees F. Follow approved manufacturer recommendations.
3. Lapping of waterstop, use of adhesives, or solvents shall not be allowed.
4. Center waterstop in joint and secure waterstop in correct position using hog rings or grommets spaced at 12" on centers along the length of the waterstop and wire tie to adjacent reinforcing steel.

B. **Strip Applied Waterstop:**

1. Refer to manufacturer installation recommendations.
2. Apply primer/adhesive to dry pipe or pipe sleeve surface, 2 inches wide continuously along the joint, maintaining a minimum of 2 inches clear cover to concrete face.
3. Primer adhesive shall be allowed to "dry to the touch" (typically 30 minutes to several hours; dependent on site conditions) prior to application of waterstop.
4. Continuously adhere waterstop to pipe or pipe sleeve utilizing primer adhesive and maintaining a minimum of 2 inches clear cover to concrete face.
5. Apply waterstop the same day as primer adhesive.
6. Waterstop shall be butt spliced pressing ends together ensuring no separation or air pockets
7. Protect waterstop from moisture, dirt, oil, and sunlight during the progress of the work
8. Remove release paper from waterstop immediately prior to concrete placement.
9. Inspect waterstop for premature swelling, discontinuity, and debris contamination prior to concrete pour. Replace unacceptable waterstop.
10. Place and thoroughly vibrate concrete, taking care not to disturb or displace the waterstop. Do not allow vibrator to contact the waterstop.

- END OF SECTION -

SECTION 03200
REINFORCEMENT STEEL

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. Furnish, fabricate and place all concrete reinforcement steel, welded wire fabric, couplers, and concrete inserts for use in reinforced concrete construction and perform all appurtenant work, including installation of all the wires, clips, supports, chairs, spacers, and other accessories, all in accordance with the Contract Documents.

1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. **Codes:** All codes, as referenced herein are specified in Section 01090 - Reference Standards.

B. **Commercial Standards**:

ACI 315	Details and Detailing of Concrete Reinforcement
ACI 318	Building Code Requirements for Reinforced Concrete
CRSI MSP-1	Concrete Reinforcing Steel Institute Manual of Standard Practice
AWS D1.4	Structural Welding Code - Reinforcing Steel
ASTM A 82	Specification for Steel Wire, Plain, for Concrete Reinforcement
ASTM A 615	Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A 775	Specification for Epoxy-Coated Reinforcing Steel Bars

1.3 SUBMITTALS

C. Submittals shall be furnished in accordance with Section 01300 - Submittals.

B. Submittals shall include shop bending diagrams, placing lists, drawings of all reinforcement steel prior to fabrication and mill test reports.

C. Details of the concrete reinforcement steel and concrete inserts shall be submitted at the earliest possible date after receipt by the CONTRACTOR of the Notice to Proceed. Said details of reinforcement steel for fabrication and erection shall conform to ACI 315 and the requirements specified and shown. The shop bending diagrams shall show the actual lengths of bars, to the nearest inch measured to the intersection of the extensions (tangents for bars of circular cross section) of the outside surface. The shop drawings shall include bar placement diagrams, which clearly indicate the dimensions of each bar splice.

D. Where mechanical couplers are required or permitted to be used to splice reinforcement steel, submit manufacturer's literature which contains instructions and recommendations for installation for each type of coupler used; certified test reports which verify the load capacity of each type and size of coupler used; and shop drawings which show the location of each coupler with details of how they are to be installed in the formwork.

E. If reinforcement steel is spliced by welding at any location, submit mill test reports, which shall contain the information necessary for the determination of the carbon equivalent as specified in AWS D1.4. Submit a written welding procedure for each type of weld for each size of bar which is to be spliced by welding; merely a statement that AWS procedures will be followed is not acceptable.

F. Submit all reinforcing product mill certificates.

1.4 QUALITY ASSURANCE

A. If requested by the ENGINEER, the CONTRACTOR shall provide samples from each heat of reinforcement steel delivered in a quantity adequate for testing. Costs of all tests will be paid by the CONTRACTOR.

B. If reinforcement steel is spliced by welding at any location, the CONTRACTOR shall submit certifications of procedure qualifications for each welding procedure used and certification of welder qualifications, for each welding procedure, and for each welder performing the work. Such qualifications shall be as specified in AWS D1.4.

C. If requested by the ENGINEER, the CONTRACTOR shall provide samples of each type of welded splice used in the WORK in a quantity and of dimensions adequate for testing. At the discretion of the ENGINEER, radiographic testing of direct butt-welded splices will be performed. The CONTRACTOR shall provide assistance necessary to facilitate testing. The CONTRACTOR shall repair any weld, which fails to meet the requirements of AWS D1.4. The costs of testing will be paid by the CONTRACTOR.

PART 2 – PRODUCTS

2.1 REINFORCEMENT STEEL

A. Reinforcement Steel for all cast-in-place reinforced concrete construction shall conform to the following requirements:

1. Bar reinforcement shall conform to the requirements of ASTM A 615 for Grade 60 Billet Steel Reinforcement or as otherwise shown.
2. Welded wire fabric reinforcement shall conform to the requirements of ASTM A 185 and the details shown; provided, that welded wire fabric with longitudinal wire of W4 size wire and smaller shall be either furnished in flat sheets or in rolls with a core diameter of not less than 10 inches; and provided further, that welded wire fabric with longitudinal wires larger than W4 size shall be furnished in flat sheets only.
3. Spiral reinforcement shall be cold-drawn steel wire conforming to the requirements of ASTM A 82.

B. **Accessories:**

1. Accessories shall include all necessary chairs, slab bolsters, concrete blocks, tie wires, dips, supports, spacers and other devices to position reinforcement during concrete placement. All bar supports shall meet the requirements of the CRSI Manual of Standard Practice including special requirements for supporting epoxy coated reinforcing bars. Wire bar supports shall be CRSI Class 1 for maximum protection with a $^1/_8$-inch minimum thickness of plastic coating, which extends at least ½-inch from the concrete surface. Plastic shall be gray in color.
2. Concrete blocks (dobies), used to support and position reinforcement steel, shall have the same or

higher compressive strength as specified for the concrete in which it is located. Wire ties shall be embedded in concrete block bar supports.

C. Epoxy coating for reinforcing and accessories, where specified or shown, shall conform to ASTM A 775.

2.2 MECHANICAL COUPLERS

A. Mechanical couplers shall be provided where shown and where approved by the ENGINEER. The couplers shall develop a tensile strength, which exceeds 125% of the yield strength of the reinforcement bars being spliced at each splice.

B. Where the type of coupler used is composed of more than one component, all components required for a complete splice shall be supplied. This shall apply to all mechanical splices, including those splices intended for future connections.

C. The reinforcement steel and coupler used shall be compatible for obtaining the required strength of the connection. Straight threaded type couplers shall require the use of the next larger size reinforcing bar or shall be used with reinforcing bars with specially forged ends which provide upset threads which do not decrease the basic cross section of the bar.

D. Couplers shall be **Lenton Form Saver as manufactured by Erico Products; Dowel Bar Splicer System as manufactured by Richmond Screw Anchor Company;** or ENGINEER approved equal.

2.3 WELDED SPLICES

A. Welded splices shall be provided where shown and where approved by the ENGINEER. All welded splices of reinforcement steel shall develop a tensile strength, which exceeds 125% of the yield strength of the reinforcement bars, which are connected.

B. All materials required to conform the welded splices to the requirements of AWS D1.4 shall be provided.

2.4 EPOXY GROUT

A. Epoxy for grouting reinforcing bars shall be specifically formulated for such application, for the moisture condition, application temperature and orientation of the hole to be filled. Epoxy grout shall meet the requirements found in Section 03315 - Grout.

PART 3 – EXECUTION

3.1 GENERAL

A. All reinforcement steel, welded wire fabric, couplers and other appurtenances shall be fabricated, and placed in accordance with the requirements of the Building Code and the Supplementary Requirements specified herein.

3.2 FABRICATION

A. **General:**

1. Reinforcement steel shall be accurately formed to the dimensions and shapes shown, and the fabricating details shall be prepared in accordance with ACI 315 and ACI 318, except as modified by the Contract Drawings. Stirrups and tie bars shall be bent around a pin having a diameter not less than 1½-inch for No. 3 bars, 2-inch for No. 4 bars, and 2½-inch for No. 5 bars. Bends for other bars shall be made around a pin having a diameter not less than 6 times the bar diameter, except for bars larger than 1-inch, in which case the bends shall be made around a pin of 8 bar diameters. Bars shall be bent cold.

2. The CONTRACTOR shall fabricate reinforcement bars for structures in accordance with bending diagrams, placing lists and placing drawings. Said drawings, diagrams and lists shall be prepared by the CONTRACTOR as specified under Section 01300 - Submittals.

B. **Fabricating Tolerances:** Bars used for concrete reinforcement shall meet the following requirements for fabricating tolerances:

1. Sheared length: ± 1-inch
2. Depth of truss bars: + 0, - ½-inch
3. Stirrups, ties and spirals: ± ½-inch
4. All other bends: ± 1-inch

3.3 PLACING

A. Reinforcement steel shall be accurately positioned as shown, and shall be supported and wired together to prevent displacement, using annealed iron wire ties or suitable clips at intersections. All reinforcement steel shall be supported by concrete, plastic or metal supports, spacers or metal hangers, which are strong and rigid enough to prevent any displacement of the reinforcement steel. Where concrete is to be placed on the ground, supporting concrete blocks (or dobies) shall be used, in sufficient numbers to support the bars without settlement, but in no case shall such support be continuous. All concrete blocks used to support, reinforcement steel shall be tied to the steel with wire ties, which are embedded in the blocks. For concrete over formwork, the CONTRACTOR shall furnish concrete, metal, plastic or other acceptable bar chairs and spacers.

B. **Limitations on the use of bar support materials shall be as follows:**

1. Concrete Dobies: Permitted at all locations except where architectural finish is required.
2. Wire Bar Supports: Permitted only at slabs over dry areas, interior dry wall surfaces and exterior wall surfaces.
3. Plastic Bar Supports: Permitted at all locations except on grade.

C. Tie wires shall be bent away from the forms in order to provide the specified concrete coverage.

D. Bars additional to those shown which may be found necessary or desirable by the ENGINEER for the purpose of securing reinforcement in position shall be provided by the CONTRACTOR at its own expense.

E. Unless otherwise specified, reinforcement placing tolerances shall be within the limits specified in Section 7.5 of ACI 318 except where in conflict with the requirements of the Building Code.

F. Bars may be moved as necessary to avoid interference with other reinforcement steel, conduits or embedded items. If bars are moved more than one bar diameter, or enough to exceed the above tolerances, the resulting arrangement of bars shall be as acceptable to the ENGINEER.

G. Accessories supporting reinforcing bars shall be spaced such that there is no deflection of the accessory from the weight of the supported bars. When used to space the reinforcing bars from wall forms, the forms and bars shall be located so that there is no deflection of the accessory when the forms are tightened into position.

3.4 SPACING OF BARS

A. The clear distance between parallel bars (except in columns and between multiple layers of bars in beams) shall be not less than the nominal diameter of the bars nor less than $1^1/_3$ times the maximum size of the coarse aggregate, nor less than 1-inch.

B. Where reinforcement in beams or girders is placed in two (2) or more layers, the clear distance between layers shall be not less than one inch.

C. In columns, the clear distance between longitudinal bars shall be not less than 1½ times the bar diameter, nor less than 1½ times the maximum size of the coarse aggregate, nor less than 1½ inches.

D. The clear distance between bars shall also apply to the distance between a contact splice and adjacent splices or bars.

3.5 SPLICING

A. **General:**

1. Reinforcement bar splices shall only be used at locations shown. When it is necessary to splice reinforcement at points other than where shown, the character of the splice shall be as acceptable to the ENGINEER.
2. Unless, otherwise indicated, dowels shall match the size and spacing of the spliced bar.

B. **Splices of Reinforcement:**

1. The length of lap for reinforcement bars, unless otherwise shown shall be in accordance with ACI 318-89, Section 12.15.1 for a Class B splice.
2. Splices in column spiral reinforcement, when necessary, shall be made by welding or by a lap of 1½ turns.

C. **Bending or Straightening:** Reinforcement shall not be straightened or rebent in a manner, which will injure the material. Bars with kinks or bends not shown shall not be used. All bars shall be bent cold, unless otherwise permitted by the ENGINEER. No bars partially embedded in concrete shall be field-bent except as shown or specifically permitted by the ENGINEER.

D. Couplers, which are located at a joint face, shall be a type, which can be set either flush or recessed from the face. The couplers shall be sealed during concrete placement to completely eliminate concrete or cement paste from entering. Couplers intended for future connections shall be recessed a minimum of ½-inch from the concrete surface. After the concrete is placed, the coupler shall be plugged with plastic plugs, which have an O-ring seal and the recess filled with sealant to prevent any contact with water or other corrosive materials. Threaded couplers shall be plugged.

E. Unless noted otherwise, mechanical coupler spacing and capacity shall match the spacing and capacity of the reinforcing shown for the adjacent section.

3.6 CLEANING AND PROTECTION

A. Reinforcement steel shall at all times be protected from conditions conducive to corrosion until concrete is placed around it.

B. The surfaces of all reinforcement steel and other metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar and other foreign substances immediately before the concrete is placed. Where there is delay in depositing concrete, reinforcement shall be reinserted and, if necessary recleaned.

3.7 EMBEDMENT OF DRILLED REINFORCING STEEL DOWELS

A. **Hole Preparation:**

1. The hole diameter shall be as recommended by the epoxy manufacturer but shall be no larger than 0.25-inch greater than the diameter of the outer surface of the reinforcing bar deformations.
2. The depth of the hole shall be as recommended by the epoxy manufacturer to fully develop the bar but shall not be less than 12 bar diameters, unless noted otherwise.
3. The hole shall be drilled by methods, which do not interfere with the proper bonding of epoxy.
4. Existing reinforcing steel in the vicinity, of proposed holes shall be located prior to drilling. The location of holes to be drilled shall be adjusted to avoid drilling through or nicking any existing reinforcing bars.
5. The hole shall be blown clean with clean, dry compressed air to remove all dust and loose particles.
6. Epoxy shall be injected into the hole through a tube placed to the bottom of the hole. The tube shall be withdrawn as epoxy is placed but kept immersed to prevent formation of air pockets. The hole shall be filled to a depth that insures that excess material will be expelled from the hole during dowel placement.
7. Dowels shall be twisted during insertion into the partially filled hole so as to guarantee full wetting of the bar surface with epoxy. The bar shall be inserted slowly enough to avoid developing air pockets.

- END OF SECTION -

SECTION 03290
JOINTS IN CONCRETE

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. Construct all joints in concrete at the locations shown. Joints required in concrete structures are of various types and will be permitted only where shown, unless specifically accepted by the ENGINEER.

1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. **Related Sections:**

1. Section 01300 – Submittals
2. Section 01400 – Quality Control.
3. Section 03100 – Concrete Formwork
4. Section 03150 – Concrete Accessories
5. Section 03300 – Cast-In-Place Concrete

B. **Commercial Standards:**

ASTM C 920	Specifications for Elastomeric Joint Sealants
ASTM D 412	Test Methods for Rubber Properties in Tension
ASTM D 624	Test Method for Rubber Property – Tear Resistance
ASTM D 638	Test Method for Tensile Properties of Plastics
ASTM D 746	Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
ASTM D 747	Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam
ASTM D 1056	Specification for Flexible Cellular Materials – Sponge or Expanded Rubber
ASTM D 1752	Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 2240	Test Method for Rubber Property – Durometer Hardness
ASTM D 2241	Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR-Series)

1.3 TYPES OF JOINTS

A. **Construction Joints:** Provide where shown on the plans. When fresh concrete is placed against a hardened concrete surface, the joint between the two (2) pours is called a construction joint. Unless otherwise specified, all joints in water bearing members shall be provided with a waterstop and sealant groove of the shape specified and shown. The space so formed shall be filled with a joint sealant material as specified in Section 07920 – Caulking and Joint Sealant.

B. **Contraction Joints:** Provide where shown on the plans. Contraction joints are similar to construction joints except that the fresh concrete shall not bond to the hardened surface of the first pour, which shall be coated

with a bond breaker. The slab reinforcement shall be stopped 4½ inches from the joint; which is provided with a sleeve-type dowel, to allow shrinkage of the concrete of the second pour. Waterstop and/or sealant groove shall also be provided when specified or shown.

C. **Expansion Joints:** Provide where shown on the plans. To allow the concrete to expand freely, a space is provided between the two pours, the joint shall be formed as shown. This space is obtained by placing a filler joint material against the first pour, which acts as a form for the second pour. Unless otherwise specified, all expansion joints in water bearing members shall be provided with a waterstop as shown.

D. The space so formed shall be filled with a joint sealant material as specified in Section 07920 – Caulking and Joint Sealant. In order to keep the two (2) walls or slab elements in line the joint shall also be provided with a sleeve-type dowel as shown.

E. **Control Joints:** The function of the control joint is to provide a weaker plane in the concrete, where shrinkage cracks will probably occur. A groove, of the shape and dimensions shown, is formed or saw-cut in the concrete. This groove is afterward filled with a joint sealant material as specified in Section 07920 – Caulking and Joint Sealant.

1.4 SUBMITTALS

A. Submittals shall be furnished in accordance with Section 01300 - Submittals.

B. **Waterstops:** Prior to production of the material required under this contract, qualification samples shall be submitted. Such samples shall consist of extruded or molded sections of each size or shape to be used, and shall be accomplished so that the material and workmanship represents in all respects the material to be furnished under this contract. The balance of the material to be used under this contract shall not be produced until after the ENGINEER has reviewed the qualification samples. As defined in Section 03150 - Concrete Accessories.

C. **Joint Location:** Submit placement shop drawings showing the location and type of all joints for each structure, along with the associated pour sequence.

1.5 QUALITY ASSURANCE

A. **Waterstop Inspection:** It is required that all waterstop field joints shall be subject to rigid inspection, and no such work shall be scheduled or started without having made prior arrangements with the ENGINEER to provide for the required inspections. Not less than 24 hours notice shall be provided to the ENGINEER for scheduling such inspections.

B. All field joints in waterstops shall be subject to rigid inspection for misalignment, bubbles, inadequate bond, porosity, cracks, offsets and other defects, which would reduce the potential resistance of the material to water pressure at any point. All defective joints shall be replaced with material, which shall pass said inspection, and all faulty material shall be removed from the site and disposed of at no additional cost.

C. The following waterstop defects represent a partial list of defects, which shall be grounds for rejection:

1. Offsets at joints greater than $^{1}/_{16}$-inch or 15% of material thickness, at any point, whichever is less.
2. Exterior crack at joint, due to incomplete bond, which is deeper than $^{1}/_{16}$-inch or 15% of material thickness, at any point, whichever is less.
3. Any combination of offset or exterior crack which will result in a net reduction in the cross section of the waterstop in excess of $^{1}/_{16}$-inch or 15% of material thickness at any point, whichever is less.
4. Misalignment of joint, which result in misalignment of the waterstop in excess of ½-inch in 10 feet.

5. Porosity in the welded joint as evidenced by visual inspection.
6. Bubbles or inadequate bonding which can be detected with a penknife test. (If, while prodding the entire joint with the point of a pen knife, the knife breaks through the outer portion of the weld into a bubble, the joint shall be considered defective.)

D. **Waterstop Samples:** Prior to use of the waterstop material in the field, a sample of each size or shape of material to be used shall be submitted to the ENGINEER for review. These samples shall be fabricated so that the material and workmanship represent in all respects the fittings to be furnished under this contract. Field samples of fabricated fittings (crosses, tees, etc.) may be selected at random by the ENGINEER for testing by a laboratory at no additional expense to the ENGINEER. When tested, they shall have a tensile strength across the joints equal to at least 600 psi.

E. **Construction Joint Sealant:** See Section 07920 – Caulking and Joint Sealant

PART 2 – PRODUCTS

2.1 PVC AND HYDROPHILIC WATERSTOP

A. **General:** As defined in Section 03150 – Concrete Accessories.

2.2 BACKING ROD

A. Backing rod shall be an extruded closed-cell, polyethylene foam rod. The material shall be compatible with the joint sealant material used and shall have a tensile strength of not less than 40 psi and a compression deflection of approximately 25% at 8 psi. The rod shall be $^1/_8$-inch larger in diameter than the joint width except that a 1-inch diameter rod shall be used for a ¾-inch wide joint.

2.3 BOND BREAKER

A. Bond breaker shall be **Super Bond Breaker as manufactured by Burke Company, San Mateo, California; Select Cure CRB as manufactured by Select Products Co., Upland, California;** or ENGINEER approved equal. It shall contain a fugitive dye so that areas of application will be readily distinguishable. Provide where shown on the plans.

2.4 SLIP DOWELS

A. Slip dowels in joints shall be A36 smooth epoxy-coated bars, conforming to ASTM A 775. Provide where shown on the plans.

PART 3 – EXECUTION

3.1 GENERAL

A. Waterstops of the type specified herein shall be embedded in the concrete across joints as shown. All waterstops shall be fully continuous for the extent of the joint. Splices necessary to provide such continuity shall be accomplished in conformance to printed instructions of manufacturer of the waterstops. Suitable precautions and means to support and protect the waterstops during the progress of the work and shall repair or replace at its own expense any waterstops damaged during the progress of the work shall be taken. All waterstops shall be stored so as to permit free circulation of air around the waterstop material.

B. When any waterstop is installed in the concrete on one side of a joint, while the other half or portion of the waterstop remains exposed to the atmosphere for more than 2 days, suitable precautions shall be taken to shade and protect the exposed waterstop from direct rays of the sun during the entire exposure and until the exposed portion of the waterstop is embedded in concrete.

3.2 SPLICES IN WATERSTOPS

A. When applicable, splices in waterstops shall be performed by heat-sealing the adjacent waterstop sections in accordance with the manufacturer's printed recommendations. It is essential that:

1. The material not be damaged by heat sealing.
2. The splices have a tensile strength of not less than 60 percent of the unspliced materials tensile strength.
3. The continuity of the waterstop ribs and of its tubular center axis be maintained.

B. Butt joints of the ends of two (2) identical waterstop sections may be made while the material is in the forms.

C. All joints with waterstops involving more than two (2) ends to be jointed together, and all joints which involve an angle cut, alignment change, or the joining of two (2) dissimilar waterstop sections shall be prefabricated prior to placement in the forms, allowing not less than 24-inch long strips of waterstop material beyond the joint. Upon being inspected and approved, such prefabricated waterstop joint assemblies shall be installed in the forms and the ends of the 24-inch strips shall be butt welded to the straight run portions of waterstop in place in the forms.

D. Where a centerbulb waterstop intersects and is jointed with a non-centerbulb waterstop, care shall be taken to seal the end of the centerbulb, using additional PVC material if needed.

3.3 JOINT CONSTRUCTION

A. **Setting Waterstops:** In order to eliminate faulty installation that may result in joint leakage, particular care shall be taken of the correct positioning of the waterstops during installation. Adequate provisions must be made to support and anchor the waterstops during progress and to insure the proper placement and or embedment in the concrete. The symmetrical halves of the waterstops shall be equally divided between the concrete pours at the joints. The center axis of the waterstops shall be coincident with the joint openings. Maximum density and imperviousness of the concrete shall be insured by thoroughly working it near all joints.

B. In placing flat-strip hydrotite waterstops in the forms, means shall be provided to prevent them from being folded over by the concrete as it is placed. Unless otherwise shown, all hydrotite waterstops shall be held in place with light wire ties on 12-inch centers, which shall be passed through the edge of the hydrotite waterstop and tied to the curtain of reinforcing steel. Horizontal hydrotite waterstops, with their flat face in a vertical plane, shall be held in place with continuous supports to which the top edge of the hydrotite waterstop shall be tacked. In placing concrete around horizontal hydrotite waterstops, with their flat face in a horizontal plane, concrete shall be worked under the hydrotite waterstops by hand so, as to avoid the formation of air and rock pockets.

C. In placing centerbulb waterstops in expansion joints, the centerbulb shall be centered on the joint filler material.

D. Waterstop in vertical wall joints shall stop 6 inches from the top of the wall where such waterstop does not connect with any other waterstop and is not to be connected to for a future concrete placement.

E. **Joint Location:** Construction joints, and other types of joints, shall be provided where shown. When not shown, construction joints shall be provided at 25-foot maximum spacing for all concrete construction, unless noted otherwise. Where joints are shown spaced greater than 40-feet apart, additional joints shall be provided to maintain the 25-foot maximum spacing. The location of all joints, of any type, shall be submitted for acceptance by the ENGINEER.

F. **Joint Preparation:** Special care shall be used in preparing concrete surfaces at joints where bonding between two (2) sections of concrete is required. Unless otherwise shown, such bonding will be required at all horizontal joints in walls. Surfaces shall be prepared in accordance with the requirements of Section 03300 - Cast-in-Place Concrete. Except on horizontal wall construction joints, wall to slab joints or where otherwise shown or specified, at all joints where waterstops are required, the joint face of the first pour shall be coated with a bond breaker as shown on the plans.

G. **Construction Joint Sealant:** Construction joints in water-bearing floor slabs, and elsewhere as shown, shall be provided with tapered grooves, which shall be filled with a construction joint sealant. The material used for forming the tapered grooves shall be left in the grooves until just before the grooves are cleaned and filled with joint sealant. After removing the forms from the grooves, all laitance and fins shall be removed, and the grooves shall be sandblasted. The grooves shall be allowed to become thoroughly dry, after which they shall be blown out; immediately thereafter, install the joint sealant per Section 07920 – Caulking and Joint Sealant they shall be primed, bond breaker tape placed in the bottom of the groove, and filled with the construction joint sealant. The primer used shall be supplied by the same manufacturer supplying the sealant. No sealant will be permitted to be used without a primer. Care shall be used to completely fill the sealant grooves. Areas designated to receive a sealant fillet shall be thoroughly cleaned, as outlined for the tapered grooves, prior to application of the sealant.

- END OF SECTION -

SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. Furnish all materials for concrete in accordance with the provisions of this Section and form, mix, place, cure, repair, finish, and do all other work as required to produce finished concrete, in accordance with the requirements of the Contract Documents.

B. **Soils Report:** This work shall conform to the requirements of the latest Geotechnical Evaluation and or Soils Report.

C. **The following types of concrete are covered in this Section:**

1. Structural Concrete: Concrete to be used in all cases except where indicated otherwise in the Contract Documents.
2. Sitework Concrete: Concrete to be used for curbs, gutters, catch basins, sidewalks, pavements, fence and guard post embedment, underground duct bank encasement and all other concrete appurtenant to electrical facilities unless otherwise indicated.
3. Lean Concrete: Concrete to be used for thrust blocks, pipe trench cut-off blocks and cradles that are detailed on the Drawings as un-reinforced. Lean concrete shall be used as protective cover for dowels intended for future connection.

D. The term "hydraulic structure" used in these specifications means environmental engineering concrete structures for the containment, treatment or transmission of water, wastewater or other fluids.

1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. **Related Sections:**

1. Section 01300 – Submittals.
2. Section 01400 – Quality Control
3. Section 03100 – Concrete Formwork
4. Section 03200 – Reinforcement Steel
5. Section 03290 – Joints in Concrete.
6. Section 03315 – Grout
7. Section 03931 – Epoxy Injection System

B. **Commercial Standards:**

ACI 117	Standard Tolerances for Concrete Construction and Materials
ACI 214	Recommended Practice for Evaluation of Strength Test Results of Concrete
ACI 301	Structural Concrete for Buildings
ACI 306.1	Cold Weather Concreting
ACI 309	Consolidation of Concrete

ACI 315	Details and Detailing of Concrete Reinforcement
ACI 318	Building Code Requirements for Reinforced Concrete
ACI 350R	Environmental Engineering Concrete Structures
ASTM C 31	Practices for Making and Curing Concrete Test Specimens in the Field
ASTM C 33	Concrete Aggregates
ASTM C 39	Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C 94	Ready-Mixed Concrete
ASTM C 136	Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C 143	Test Method for Slump of Hydraulic Cement Concrete
ASTM C 150	Portland Cement
ASTM C 156	Test Methods for Water Retention by Concrete Curing Materials
ASTM C 157	Test Method for Length Change of Hardened Hydraulic Cement Mortar and Concrete
ASTM C 192	Practices for Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 260	Air-Entraining Admixtures for Concrete
ASTM C 309	Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 494	Chemical Admixtures for Concrete
ASTM C 1077	Practice for Laboratories Testing Concrete and Concrete Aggregates for use in Construction & Criteria for Laboratory Evaluation
ASTM D 175	Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)
ASTM D 448	Classifications for Sizes of Aggregate for Road and Bridge Construction
ASTM D 2419	Test Method for Sand Equivalent Value of Soils and Fine Aggregate
ASTM E 119	Method for Fire Tests of Building Construction and Materials

1.3 SYSTEM DESCRIPTIONS

A. **Performance Requirements:**

1. General:

a. Except as otherwise specified, provide concrete composed of Portland cement, aggregate, and water so proportioned and mixed as to produce plastic, cohesive workable mixture in accordance with requirements as specified in this Section and suitable to specific conditions of placement.
b. Proportion fine and coarse aggregates in a manner such as not to produce harshness in placing nor honeycombing in structures.

2. Water tightness of Concrete Work: It is intent of this Section to secure for every part of the Work concrete and grout of homogeneous structure, which when hardened will have required strength, water tightness, and durability. As provided in ACI 350.1/350.1R Concrete for Environmental Structures.

a. It is recognized that some surface hairline cracks and crazing will develop in the concrete surfaces.
b. Construction, contraction, and expansion joints have been positioned in structures as indicated on the Drawings, and curing methods specified, for purpose of reducing number and size of these expected from specified concrete mixes.
c. Watertight: Repair cracks as described in this Section which develop in walls or slabs and repair cracks which show any signs of leakage until all leakage is stopped.
d. If patching does not stop the leakage and at the ENGINEER's discretion the installing CONTRACTOR shall pressure inject visible cracks, other than hairline cracks and crazing, in following areas with epoxy as specified in Section 03931.

1) Floors and walls of water bearing structures.
2) Walls and overhead slabs of passageways or occupied spaces, outsides of which are exposed to weather or may be washed down and are not specified to receive separate waterproof membrane.
3) Other Items Not Specified to Receive Separate Waterproof Membrane: Slabs over water channels, wet walls, reservoirs, and other similar surfaces.

3. Workmanship and Methods: Provide concrete work, including detailing of reinforcing, conforming with best standard practices and as set forth in ACI 318, Manuals, and Recommended Practices.

1.4 SUBMITTALS

A. Submittals shall be furnished in accordance with Section 01300 - Submittals.

B. **Product Data:** Submit data completely describing products.

C. **Information on Heating Equipment to Be Used for Cold Weather Concreting:** Submit information on type of equipment to be used for heating materials and/or new concrete in process of curing during excessively cold weather.

D. **For conditions that promote rapid drying of freshly placed concrete such as low humidity, high temperature, and wind:** Submit corrective measures proposed for use prior to placing concrete.

E. **Copies of Tests of Concrete Aggregates:** Submit certified copies in triplicate of commercial laboratory tests not more than 90 days old of all samples of concrete aggregates.

1. Fine Aggregate:

a. Clay lumps.
b. Reactivity.
c. Shale and chert.
d. Soundness.
e. Color.
f. Decantation.

2. Coarse Aggregate:

a. Clay lumps and friable particles.
b. Reactivity.
c. Shale and chert.
d. Soundness.
e. Abrasion loss.
f. Coal and lignite.
g. Materials finer than 200 sieve.

F. **Sieve Analysis:** Submit sieve analysis of fine and coarse aggregates being used in triplicate at least every 3 weeks and at any time there is significant change in grading of materials.

G. **Concrete Mixes:** Submit full details, including mix design calculations for concrete mixes proposed for use for each class of concrete.

1. Include information on correction of batching for varying moisture contents of fine aggregate.
2. Submit source quality test records with mix design submittal.

a. Include calculations for f'c based on source quality test records.

H. **If There is Change in Aggregate Source, Aggregate Quality from Same Source**: Submit new set of design mixes covering each class of concrete.

I. **If Either Fine or Coarse Aggregate Is Batched from More than One Bin:** Submit analyses for each bin, and composite analysis made up from these, using proportions of materials to be used in mix.

J. **Cement Mill Tests:** Include alkali content, representative of each shipment of cement for verification of compliance with specified requirements.

K. **Pozzolan Certificate of Compliance:** Identify source of pozzolan and certify compliance with requirements of ASTM C 618.

L. Information on mixing equipment.

M. Drying shrinkage test data.

N. **Packing and Shipping:**

1. Deliver, store, and handle concrete materials in manner as to prevent damage and inclusion of foreign substances.
2. Deliver and store packaged materials in original containers until ready for use.
3. Deliver aggregate to mixing site and handle in such a manner that variations in moisture content will not interfere with steady production of concrete of specified degree of uniformity and slump.

O. **Acceptance at Site:** Reject material containers or materials showing evidence of water or other damage.

P. **Test Batch Test Data:**

1. Submit data for each test cylinder.
2. Submit data that identifies mix and slump for each test cylinder.

Q. **Sequence of Concrete Placing**: Submit proposed sequence of placing concrete showing proposed beginning and ending of individual placements.

R. Ties to be used and the tie hole patching procedure and methods and materials.

S. **Curing Compound Other than Specified Compound:** Submit complete data on proposed compound.

T. **Repair of Defective Concrete**: Submit mix design for grout or product data if mixed onsite.

U. **Acceptance of Method of Concrete Repair:** Make no repair until the ENGINEER has accepted method.

1.4 QUALITY ASSURANCE

A. **General**

1. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
2. Tests for compressive strength and shrinkage of concrete shall be performed as indicated herein. Test for determining slump will be in accordance with the requirements of ASTM C 143.
3. The cost of all laboratory tests on concrete will be borne by the CONTRACTOR. The laboratory will meet or exceed the requirements of ASTM C 1077.
4. Concrete for testing shall be supplied by the CONTRACTOR at no additional cost to the OWNER, and the CONTRACTOR shall assist the ENGINEER in obtaining samples, and disposal and cleanup of excess material.

B. **Field Testing of Concrete:**

1. During progress of construction, the CONTRACTOR will have tests made to determine whether the concrete, as being produced, complies with requirements specified.
2. Tests will be performed in accordance with ASTM C 31, ASTM C 39, and ASTM C 172.
3. The testing company will make and deliver test cylinders to the laboratory and testing expense will be borne by the CONTRACTOR.

4. Required Number Cylinders:

   a. Not less than 3 cylinder specimens, 6 inch diameter by 12 inch long, will be tested for each 150 cubic yards of each class of concrete placed and not less than 3 specimens for each half day's placement.
   b. One cylinder will be broken at 7 days and 2 at 28 days.

5. The Testing Agency shall:

   a. Test slump of concrete using slump cone in accordance with the requirements of ASTM C

b. Furnish test equipment.
c. Do not use the concrete that does not meet specification requirements in regards to slump, but remove such concrete from project site.
d. Test slump at the beginning of each placement, as often as necessary to keep slump within the specified range, and when requested to do so by the ENGINEER.
e. Make provisions for and furnish concrete for test specimens, and provide manual assistance to the ENGINEER in preparing said specimens.
f. Assume responsibility for care of and providing of curing conditions for test specimens in accordance with ASTM C 31.

C. **Enforcement of Strength Requirement:**

1. Concrete is expected to reach higher compressive strength than that which is indicated on the drawings and herein as specified compressive strength f'c.
2. Strength Level of Concrete: Will be considered acceptable if the following conditions are satisfied.

a. Average of all sets of 3 consecutive test results is greater or equal to specified compressive strength f'c.
b. No individual strength test (average of 2 cylinders) falls below specified compressive strength f'c by more than 500 pounds per square inch.
c. Whenever one, or both, of 2 conditions stated above is not satisfied, provide additional curing of affected portion followed by cores taken in accordance with ASTM C 42 and ACI 318 and comply with the following requirements.

1) If additional curing does not bring average of 3 cores taken in affected area to at least specified compressive strength f'c, designate such concrete in affected area as defective.
2) The ENGINEER may require the CONTRACTOR to strengthen defective concrete by means of additional concrete, all at the CONTRACTOR's expense.

E. **Construction Tolerances:** The CONTRACTOR shall set and maintain concrete forms and perform finishing operations to ensure that the completed WORK is within tolerances. Surface defects and irregularities are defined as finishes and are to be distinguished from tolerances. Tolerance is the permissible variation from lines, grades, or dimensions indicated on the Drawings. Where tolerances are not stated in the specifications, permissible deviations will be in accordance with ACI 117.

1. The following construction tolerances apply to finished walls and slab unless otherwise indicated:

Item	Tolerance
Variation of the constructed linear outline from the established position in plan.	In 10 feet: ¼-inch; In 20 feet or more: ½-inch
Variation from the level or from the grades shown.	In 10 feet: ¼-inch In 20 feet or more: ½-inch
Variation from the plumb	In 10 feet: ¼-inch; In 20 feet or more: ½-inch
Variation in the thickness of slabs and walls.	Minus ¼-inch;

	Plus ½-inch
Variation in the locations and sizes of slabs and wall openings	Plus or minus ¼-inch
Variation in weirs hydraulic control structures	Max deviation in elevation ¼ inch (total)

1.5 PROJECT CONDITIONS

A. **Environmental Requirements:**

1. Hot weather concreting:

   a. When Ambient Air Temperature Is Above 90 Degrees Fahrenheit: Prior to placing concrete, cool forms and reinforcing steel to by water cooling to below 90 degrees Fahrenheit.
   b. Temperature of Concrete Mix at Time of Placement: Keep temperature below 90 degrees Fahrenheit by methods which do not impair quality of concrete.

2. Cold Weather Concreting:

   a. Concrete placed below ambient air temperature of 45 degrees Fahrenheit and falling or below 40 degrees Fahrenheit: Make provision for heating water.
   b. If materials have been exposed to freezing temperatures to degree that any material is below 35 degrees Fahrenheit: Heat such materials.
   c. Heating Water, Cement, or Aggregate Materials:

      1) Do not heat in excess of 160 degrees Fahrenheit.

   d. Protection of Concrete in Forms:

      1) Protect by means of covering with tarpaulins, or other acceptable covering.
      2) Provide means for circulating warm moist air around forms in manner to maintain temperature of 50 degrees Fahrenheit for at least 5 days.

2. For conditions that promote rapid drying of freshly placed concrete such as low humidity, high temperature, and wind: Take corrective measures to minimize rapid water loss from concrete.

   a. Furnish and use sufficient number of maximum and minimum self-recording thermometers to adequately measure temperature around concrete.

1.6 SEQUENCING AND SCHEDULING

A. Schedule placing of concrete in such a manner as to complete any single placing operation to construction, contraction, or expansion joint.

PART 2 – PRODUCTS

2.1 CONCRETE MATERIALS

A. **Aggregate**

1. **General:**

   a. Provide concrete aggregates that are sound, uniformly graded, and free of deleterious material in excess of allowable amounts specified.
   b. Grade aggregate in accordance with ASTM D 75 and C 136.
   c. Provide unit weight of fine and coarse aggregate which produces in place concrete with weight of not less than 140 pounds per cubic foot.

B. **Fine Aggregate:**

1. Provide fine aggregate for concrete or mortar consisting of clean, natural sand or of sand prepared from crushed stone or crushed gravel.
2. Do not provide aggregate having deleterious substances in excess of the following percentages by weight of contaminating substances. In no case shall total exceed percent listed.

Item	Test Method	Percent
Removed by decantation (dirt, silt, etc.)	**ASTM C 117**	3
Shale or Chert	**ASTM C 295**	1
Clay Lumps	**ASTM C 142**	1

3. Except as otherwise specified, grade fine aggregate from coarse to fine in accordance with requirements of ASTM C 33.

C. **Coarse Aggregate:**

1. General: Provide coarse aggregate consisting of gravel or crushed stone made up of clean, hard, durable particles free from calcareous coatings, organic matter, or other foreign substances.
2. Weight: Not exceeding 15 percent, for thin or elongated pieces having length greater than 5 times average thickness.
3. Deleterious Materials: Not in excess of following percentages by weight, and in no case having total of all deleterious substances exceeding 2 percent.

Item	Test Method	Percent
Shale or chert	**ASTM C 295**	1
Coal and lignite	**ASTM C 123**	¼
Clay Lumps and friable particles	**ASTM C 142**	¼
Materials finer than Number 200 sieve	**ASTM C 117**	½*
Note: (*) Except when material finer than Number 200 sieve consists of crusher dust, maximum amount shall be 1 percent>		

4. Grading:

   a. Aggregate: As specified in ASTM C 33, Size Number 57, except as otherwise specified or authorized in writing by the ENGINEER.
   b. Aggregate for Concrete for Encasement of Electrical Conduits:

      1) Graded as specified in ASTM C 33, Size Number 8.
      2) Provide concrete utilizing this aggregate equal to 2500 psi concrete in all other respects, and is designated as Class CE.

D. **Portland Cement:**

1. General: Conform to specifications and tests for ASTM C 150, except as specified otherwise.

2. Low Alkali Portland: Have total alkali containing not more than 0.60 percent, unless specified otherwise, and or where soil conditions permit such use.

3. Exposed Concrete in Any Individual Structure: Use only one brand of Portland cement.

4. Cement for Finishes: Provide cement from the same source and of same type as concrete to be finished.

E. **Admixtures:**

5. General:

   a. Do not use admixtures of any type, except as specified, unless written authorization has been obtained from the ENGINEER.
   b. Compatible with concrete and other admixtures.
   c. Do not use admixtures containing chlorides calculated as chloride ion in excess of 0.5 percent by weight.
   d. Use in accordance with manufacturer's recommendations and add each admixture to concrete mix separately.

6. Water Reducing Admixture:

   a. May be used at the CONTRACTOR's option.
   b. Conform to ASTM C 494, Type A or Type D.
   c. Not contain air entraining agents.
   d. Liquid form before adding to the concrete mix.
   e. No decrease in cement is permitted as result of use of water reducing admixture.

7. Superplasticizers or Flyash: Are not to be used without acceptance by ENGINEER.

F. **Water:**

1. Water for Concrete, Washing Aggregate, and Curing Concrete: Clean and free from oil and deleterious amounts of alkali, acid, organic matter, or other substances.

2. Chlorides and Sulfate Ions:

   a. Water for Conventional Reinforced Concrete: Use water not containing more than 1,000 (mg/L) of chlorides calculated as chloride ion, no more than 1,000 (mg/L) of sulfates calculated as sulfate ion.
   b. Water for Pre-stressed or Post-tensioned Concrete: Use water not containing more than 650 (mg/L) milligrams per liter of chlorides calculated as chloride ion, nor more than 800 (mg/l) of sulfates calculated as sulfate ion.

G. **Conduit Encasement Coloring Agent:**

1. Color: Red color concrete used for encasement of electrical ducts, conduits, and similar type items.

2. Manufacturers: One of the following or equal.

   a. Frank D, Davis Company, Red Oxide Number 117.
   b. I. Reiss Company, Inc., equivalent product.

3. Conduit Encasement Concrete: Mix into each cubic yard of concrete 10 pounds of coloring agent.

H. **Keyway Material:** Lumber.

I. All curing compounds shall be white pigmented and resin based conforming to ASTM C 309, Type D. Sodium silicate compounds shall not be allowed. Concrete curing compound shall be **Kurez by Euclid Chemical Company; MB-429 as manufactured by Mater Builders; L&M Cure R;** or equal. Water based resin curing compounds shall be used only where local air quality regulations prohibit the use of a solvent based compound. Water based curing compounds shall be **Aqua-Cure by Euclid Chemical Company; Masterkure-W by Master Builders; L&M Cure R-2;** or equal.

J. **Manufacturers:** One of the following or equal.

1. WR Meadows
2. CGM Incorporated

K. **Plastic Membrane Curing:** Use polyethylene film.

1. **Color:** White
2. **Thickness:** Minimum 6 mils.
3. **Loss of Moisture:** Not to exceed 0.055 grams per square centimeter of surface when tested in accordance with ASTM C 156.

2.2 CONCRETE DESIGN REQUIREMENTS

A. **General:** Concrete shall be composed of cement, admixtures, aggregates, and water of the qualities indicated. The exact proportions in which these materials are to be used for different parts of the work will be determined during the trial batch. In general, the mix shall be designed to produce a concrete capable of being deposited so as to obtain maximum density and minimum shrinkage, and, where deposited in forms, to have good consolidation properties and maximum smoothness of surface. The aggregate gradations shall be formulated to provide fresh concrete that will not promote rock pockets around reinforcing steel or embedded items. The proportions shall be changed whenever necessary or desirable to meet the required results at no additional cost to the OWNER. All changes shall be subject to review by the ENGINEER.

B. **Fine Aggregate Composition:** In mix designs for structural concrete, the percentage of fine aggregate in total aggregate by weight, shall be as indicated in the following table.

Fine Aggregate	
Fineness Modulus	**Maximum Percent**
2.7 or less	41
2.7 to 2.8	42
2.8 to 2.9	43
2.9 to 3.0	44

For other concrete, the maximum percentage of fine aggregate of total aggregate, by weight, shall not exceed 50.

C. **Water-Cement Ratio and Compressive Strength:** Concrete shall have the following minimum properties unless noted otherwise on the plans:

Type of Work	Min 28-Day Compr. Strength (psi)	Max Size Aggregate (in)	Minimum Cement per cu yd (lbs)	Non Air Max W/C Ratio (by weight)
Structural Concrete:	5,000	1	564	*
	4,500	1	564	0.38
	4,000	1	564	0.45
Pea Gravel Mix	4,000	$^3/_8$	752	0.40
Sitework concrete	3,000	1	470	0.50
Lean concrete	2,000	1	376	0.60

NOTES: **W/C Ratio shall be based upon the Geotechnical Evaluation and or Soils Report – Refer to the Evaluation for W/C, and other site dependent concrete recommendations**. See the Structural Plan notes for strength application and location.

The CONTRACTOR is cautioned that the limiting parameters above are not a mix design. Additional cement or water reducing agent may be required to achieve workability required by the CONTRACTOR's construction methods and aggregates. The CONTRACTOR is responsible for providing concrete with the required workability.

*For strengths above 4500 psi (non-air) concrete proportions shall be established from either existing field data or trial mixes. This information shall be submitted by the ready mix company through the CONTRACTOR for review by the ENGINEER before it will be approved. The average compressive strength from the test record must equal or exceed the ACI 318 requirements for average compressive strength.

D. **Adjustments to Mix Design:** The mixes shall be changed whenever such change is necessary or desirable to secure the required strength, density, workability, and surface finish, and the CONTRACTOR shall be entitled to no additional compensation because of such changes.

2.3 CONSISTENCY

A. The quantity of water in a batch of concrete shall be just sufficient, with a normal mixing period, to produce a concrete which can be worked properly into place without segregation and which can be compacted by vibratory methods to give the desired density, impermeability, and smoothness of surface. The quantity of water shall be changed as necessary, with variations in the nature or moisture content of the aggregates, to maintain uniform production of a desired consistency. The consistency of the concrete in successive batches shall be determined by slump tests in accordance with ASTM C 143. The slumps shall be as follows:

Part of Work	Slump (in)
All concrete, unless indicated otherwise	3 inches plus or minus 1-inch
With high range water reducer added	7 inches plus or minus 2 inches
Pea gravel mix	7 inches plus or minus 2 inches
Ductbanks	5 inches plus or minus 1-inch

2.4 MIXES

A. **Measurements of Materials:**

1. Measure materials by weighing, except as otherwise specified or where other methods are specifically authorized in writing by the ENGINEER.
2. Furnish apparatus for weighing aggregates and cement that is suitably designed and constructed for this purpose.
3. Accuracy of Weighing Devices: Furnish devices that have capability of providing successive quantities of individual material that can be measured to within one percent of desired amount of that material.
4. Measuring or Weighing Devices: Subject to review by the ENGINEER, and bear valid seal of the Sealer of Weights and Measures having jurisdiction.
5. Weighing Cement:

    a. Weigh cement separately.
    b. Cement in Unbroken Standard Packages (Sacks): Need not be weighed.
    c. Bulk Cement and Fractional Packages: Weigh such cement.

6. Mixing Water: Measured by volume or by weight.

B. **Concrete Proportions and Consistency:**

1. Concrete Consistency and Composition:

    a. Provide concrete that can be worked readily into corners and angles of forms and around reinforcement without excessive vibration and without permitting materials to segregate or free water to collect on surface.
    b. Prevent unnecessary or haphazard changes in consistency of concrete.

2. Ratio of Coarse Aggregate to Fine Aggregate: Not less than 1.0 nor more than 2.0 for all concrete Classes, with exception of Class CE.

3. Aggregate:

    a. Obtain aggregate from source which is capable of providing uniform quality, moisture content, and grading during any single day's operation.

4. Concrete Mix Water to Cement Ratio, Cement Content, and Slump Range: Conform to values specified in Section 2.2.C **and per the Geotechnical Evaluation and or Soils Report**.
5. Concrete Batch Weighs: Control and adjust so as to secure maximum yield, and at all times maintain proportions of concrete mix within specified limits.
6. Mixture Modification: If required, by the ENGINEER, modify mixture within limits set forth in this Section.

C. **Concrete Mixes:**

1. Proportioning of Concrete Mix: Proportion mixes on required average on compressive strength f'c as defined in the contract documents.
2. Mixes:

    a. Adjusting of Water: After acceptance, do not change mixes without acceptance by ENGINEER, except that at all times adjust batching of water to compensate for free moisture content of fine aggregate.
    b. Total Water Content of Each Concrete Class: Not exceed those specified in Section 2.2.C, **unless noted otherwise or specified in the Geotechnical Evaluation and or Soils Report**.
    c. Checking Moisture Content of Fine Aggregate: Furnish satisfactory means at batching plant for checking moisture content of fine aggregate.

3. Change in Mixes: Undertake new trial batch and test program as specified in this Section.

D. **Hand Mixed Concrete:**

1. Hand mix concrete only when acceptable to the ENGINEER.
2. Prepare hand mixed concrete on watertight, level platform in batches not to exceed 1/3 cubic yard each.
3. Aggregate:

    a. First spread required amount of coarse aggregate on platform in an even and uniform layer, and then over such aggregate spread proper proportion of fine aggregate.
    b. Combined Depth of Both Such Layers: Not be greater than one foot.

4. Cement:

    a. First evenly spread required quantity of cement over fine aggregate.
    b. Then turn entire batch with shovels at least twice before adding water.

5. Water:

    a. Then uniformly sprinkle or spray proper amount of water over batched materials.
    b. Then turn with shovels not less than three times before being removing from platform.

2.5 SOURCE QUALITY CONTROL

A. **Tests:**

1. Concrete Mixes:

c. After concrete mixes have been accepted by ENGINEER, have trial batches of the accepted mix designs prepared by testing laboratory acceptable to the ENGINEER.
d. Prepare trial batches by using specified cement and aggregates proposed to be use for the work.
e. Trial Batches: Provide batches of sufficient quantity to determine slump, workability, consistency, and finishing characteristics, and to provide sufficient test cylinders.
f. Test Cylinders: Provide cylinders having six inch diameter by 12 inch length and that are prepared in accordance with ASTM C 31 for tests specified in this Section.
g. Determine slump in accordance with ASTM C 143.
h. Test Cylinders from Trial Batch:

1) Test 8 cylinders for compressive strength in accordance with ASTM C 39.

a) Test 4 cylinders at 7 days and 4 at 28 days.
b) Establish ratio between 7 day and 28 day strength for mix. Seven day strength may be taken as satisfactory indication of 28 day strength provided effects on concrete of temperature and humidity between 7 day and 28 day are taken into account.

2) Average Compressive Strength of 4 Test Cylinders Tested at 28 Days: Equal to or greater than required average compressive strength f'c on which concrete mix design is based.

i. Drying Shrinkage:

1) Prepare 5 drying shrinkage specimens in accordance with ASTM C 157, except as modified herein.
2) Remove drying shrinkage specimens from molds at age of 23 hours plus or minus 1 hour after trial batching, then immediately place them in water at 73 degrees Fahrenheit plus or minus 3 degrees for at least 30 minutes and then measure specimens within 30 minutes thereafter to determine original length. Then submerge specimens in saturated lime water at 73 degrees Fahrenheit plus or minus three degrees for moist curing.
3) Make measurements to determine expansion expressed as percentage of original length at age 7 days. Use length at age 7 days as base length for drying shrinking calculations.
4) Immediately store specimens in humidity controlled room maintained at 73 degrees Fahrenheit plus or minus 3 degrees and 50 percent plus or minus 4 relative humidity for remainder of the test.
5) Make and report measurements to determine shrinkage expressed as percentage of base length separately for 7, 14, 21, and 28 days of drying after 7 days of moist curing.
6) Drying Shrinkage Deformation:

a) Measure drying shrinkage deformation of each specimen as difference

between base length and length after drying at each test age.

b) Measure average drying shrinkage deformation of specimens to nearest 0.0001 inch at each test age.

c) If drying shrinkage of any specimen departs from average of test age by more than 0.0004 inch, disregard results obtained from that specimen and test another specimen.

d) Shrinkage of trial batch concrete at 28 days drying age shall not exceed 0.045 percent maximum.

j. If trial batch tests do not meet specified requirements for slump, strength, workability, consistency, drying shrinkage, and finishing, change concrete mix design proportions and, if necessary, source of aggregate. Make additional trial batches and tests until an acceptable trial batch is produced that meets requirements of this Section.

k. Perform test batches and tests required to establish trial batches and acceptability of materials without change in Contract Price.

l. Do not place concrete until the concrete mix design and trial batch have been accepted by ENGINEER.

2. Required Average Compressive Strength:

a. Determine required average compressive strength (f'c) for selection of concrete proportions for mix design, for each class of concrete, using calculated standard deviation and its corresponding specified compressive strength f'c, in accordance with ACI 318, Part 3, Chapter 5.

b. When test records of at least 30 consecutive tests that span period of not less that 45 calendar days are available, establish standard deviation as described in ACI 318, Part 3, Chapter 5 and as modified as follows herein.

c. Provide test records from which to calculate standard deviation that represent materials, quality control procedures, and conditions similar to materials, quality control procedures, and conditions expected to apply in preparation of concrete for the Work.

d. Provide changes in materials and proportions within test records that are more restricted than those for the Work.

e. Specified Compressive Strength (f'c) of Concrete Used in Test Records : Within 1,000 pounds per square inch of that specified for the Work.

f. When lacking adequate test records for calculation of standard deviation meeting requirements, determine required average compressive strength f'c from the following table.

Specified Compressive Strength f'c (pounds per square inch)	Required Average Compressive Strength f'c (pounds per square inch)
Less than 3,000	f'c + 1,000
3,000 to 5,000	f'c + 1,200
Over 5,000	f'c + 1,400

6. **Pozzolan:**

a. Sampling and Testing:

1) Sample and test pozzolan in accordance with ASTM C 311.

2) In Computing Water to Cement Ratio and Cement Content per Cubic Yard of Concrete: Consider cement weight to be weight of Portland cement plus 100 percent of weight of fly ash.

7. **Aggregate:**

a. Testing of concrete aggregate is at CONTRACTOR's expense.
b. Sieves:

1) Use sieves with square openings for testing grading or aggregates.
2) Sieve Analysis: If sieve analysis indicates significant change in materials, the ENGINEER may require that new mix design be submitted and accepted before further placing of concrete.

c. Sample aggregate in accordance with ASTM D 75 and C 136.
d. Fine Aggregate:

1) Provide fine aggregate not containing strong alkali nor organic matter which gives color darker than standard color when tested in accordance with ASTM C 40.
2) Provide aggregate having soundness complying with requirements of ASTM C 33 when tested in accordance with ASTM C 88.
3) Provide aggregate complying with reactivity requirements of ASTM C 33 when tested in accordance with ASTM C 289.

e. Coarse Aggregate:

1) Soundness when tested in accordance with ASTM C 88: Have loss not greater than 10 percent when tested with sodium sulfate.
2) Abrasion Loss: Not exceed 45 percent after 500 revolutions when tested in accordance with ASTM C 131.
3) Reactivity: Not exceed limits specified in Appendix of ASTM C 33 when tested in accordance with ASTM C 289.

f. Portland Cement:

1) Determination Alkali Content: Determine by method set forth in ASTM C 114.

PART 3 – EXECUTION

3.1 PROPORTIONING AND MIXING

A. **Proportioning:** Proportioning of the mix shall conform to the requirements of Chapter 3 "Proportioning" of ACI 301.

B. **Mixing:** Mixing shall conform to the requirements of Chapter 7 of said ACI 301 Specifications.

C. **Slump:** Slumps shall be as indicated herein.

D. **Retempering:** Retempering of concrete or mortar which has partially hardened shall not be permitted.

3.2 PREPARATION OF SURFACES FOR CONCRETING

A. **General:** Earth surfaces shall be thoroughly wetted by sprinkling prior to the placing of any concrete, and these surfaces shall be kept moist by frequent sprinkling up to the time of placing concrete thereon. The surface shall be free from standing water, mud and debris at the time of placing concrete.

B. **Joints in Concrete:** Concrete surfaces upon or against which concrete is to be placed, where the placement of the concrete has been stopped or interrupted so that, as determined by the ENGINEER, the new concrete cannot be incorporated integrally with that previously placed, are defined as construction joints. The surfaces of horizontal joints shall be given a compacted, roughened surface for good bonding. Except where the Drawings call for joint surfaces to be coated, the joint surfaces shall be cleaned of all laitance, loose or defective concrete, foreign material, and be roughened to a minimum ¼-inch amplitude. Such cleaning and roughening shall be accomplished by hydroblasting or sandblasting (exposing aggregate) followed by thorough washing. All pools of water shall be removed from the surface of construction joints before the new concrete is placed.

C. After the surfaces have been prepared, all approximately horizontal construction joints shall be covered with a 6-inch lift of a pea gravel mix. The mix shall be placed and spread uniformly. Wall concrete shall follow immediately and shall be placed upon the fresh pea gravel mix.

D. **Placing Interruptions:** When placing of concrete is to be interrupted long enough for the concrete to take a set, the working face shall be given a shape by the use of forms or other means, that will secure proper union with subsequent work; provided that construction joints shall be made only where acceptable to the ENGINEER.

E. **Embedded Items:** No concrete shall be placed until all formwork, installation of parts to be embedded, reinforcement steel, and preparation of surfaces involved in the placing have been completed and accepted by the ENGINEER at least 4 hours before placement of concrete. All surfaces of forms and embedded items that have become encrusted with dried grout from previous work shall be cleaned before the surrounding or adjacent concrete is placed.

F. All inserts or other embedded items shall conform to the requirements herein.

G. All reinforcement, anchor bolts, sleeves, inserts, and similar items shall be set and secured in the forms at locations indicated on the Drawings or shown by shop drawings and shall be acceptable to the ENGINEER before any concrete is placed. Accuracy of placement is the responsibility of the CONTRACTOR.

H. **Casting New Concrete Against Old:** Where concrete is to be cast against old concrete (any concrete which is greater than 180 days of age), the surface of the old concrete shall be thoroughly cleaned and roughened by hydro-blasting or sandblasting (exposing aggregate). The joint surface shall be coated with an epoxy bonding agent unless indicated otherwise by the ENGINEER.

I. No concrete shall be placed in any structure until all water entering the space to be filled with concrete has been properly cut off or has been diverted by pipes, or other means, and carried out of the forms, clear of the WORK. No concrete shall be deposited underwater nor shall the CONTRACTOR allow still water to rise on any concrete until the concrete has attained its initial set. Water shall not be permitted to flow over the surface of any concrete in such manner and at such velocity as will injure the surface finish of the concrete. Pumping or other necessary dewatering operations for removing ground water, if required, shall be subject to the review of the ENGINEER.

J. **Corrosion Protection:** Pipe, conduit, dowels and other ferrous items required to be embedded in concrete construction shall be so positioned and supported prior to placement of concrete that there will be a minimum of 2 inches clearance between said items and any part of the concrete reinforcement. Securing

such items in position by wiring or welding them to the reinforcement will not be permitted.

K. Openings for pipes, inserts for pipe hangers and brackets, and anchors shall, where practicable, be provided during the placing of concrete.

L. Anchor bolts shall be accurately set and shall be maintained in position by templates while being embedded in concrete.

M. **Cleaning:** The surfaces of all metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar, and other foreign substances immediately before the concrete is placed.

3.3 HANDLING, TRANSPORTING, AND PLACING

A. **General:** Placing of concrete shall conform to the applicable requirements of Chapter 8 of ACI 301 and the requirements of this Section. No aluminum materials shall be used in conveying any concrete.

B. **Non-Conforming Work or Materials:** Concrete which during or before placing is found not to conform to the requirements indicated herein shall be rejected and immediately removed from the work. Concrete which is not placed in accordance with these Specifications, or which is of inferior quality, shall be removed and replaced by the CONTRACTOR at no additional cost to the OWNER.

C. **Unauthorized Placement:** No concrete shall be placed except in the presence of a duly authorized representative of the ENGINEER. The CONTRACTOR shall notify the ENGINEER in writing at least 24 hours in advance of placement of any concrete.

D. **Placement in Wall and Column Forms:** Concrete shall not be dropped through reinforcement steel or into any deep form, nor shall concrete be placed in any form in such a manner as to leave accumulation of mortar on the form surfaces above the placed concrete. In such cases, means such as hoppers and, if necessary, vertical ducts of canvas, rubber, or metal shall be used for placing concrete in the forms in a manner that it may reach the place of final deposit without separation. In no case shall the free fall of concrete exceed 4-feet in walls and 8-feet in columns below the ends of ducts, chutes or buggies. Concrete shall be uniformly distributed during the process of depositing and in no case after depositing shall any portion be displaced in the forms more than 6-feet in horizontal direction. Concrete in wall forms shall be deposited in uniform horizontal layers not deeper than 2-feet; and care shall be taken to avoid inclined layers or inclined construction joints except where such are required for sloping members. Each layer shall be placed while the previous layer is still soft. The rate of placing concrete in wall forms shall not exceed 5-feet of vertical rise per hour. Sufficient illumination shall be provided in the interior of all forms so that the concrete at the places of deposit is visible from the deck or runway.

E. **Casting New Concrete Against Old:** Epoxy adhesive bonding agent shall be applied to the old surfaces according to the manufacturer's written recommendations. This provision shall not apply to joints where hydrotite waterstop is provided. See Section 03290 - Joints in Concrete.

F. **Conveyor Belts and Chutes:** All ends of chutes, hopper gates, and all other points of concrete discharge throughout the CONTRACTOR'S conveying, hoisting, and placing system shall be designed and arranged so that concrete passing from them will not fall separated into whatever receptacle immediately receives it. Conveyor belts, if used, shall be of a type acceptable to the ENGINEER. Chutes longer than 50-feet will not be permitted. Minimum slopes of chutes shall be such that concrete of the indicated consistency will readily flow in them. If a conveyor belt is used, it shall be wiped clean by a device operated in such a manner that none of the mortar adhering to the belt will be wasted. All conveyor belts and chutes shall be covered.

G. **Placement in Slabs:** Concrete placed in sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the placement. As the work progresses, the concrete shall be vibrated and carefully worked around the slab reinforcement, and the surface of the slab shall be screeded in an up-slope direction.

H. **Temperature of Concrete:** The temperature of concrete when it is being placed shall be not more than 90 degrees F nor less than 55 degrees F for sections less than 12 inches thick nor less than 50 degrees for all other sections. Concrete ingredients shall not be heated to a temperature higher than that necessary to keep the temperature of the mixed concrete, as placed, from falling below the minimum temperature. When the temperature of the concrete is 85 degrees F or above, the time between the introduction of the cement to the aggregates and discharge shall not exceed 45 minutes. If concrete is placed when the weather is such that the temperature of the concrete would exceed 90 degrees F, the CONTRACTOR shall employ effective means, such as pre-cooling of aggregates and mixing water using ice or placing at night, as necessary to maintain the temperature of the concrete, as it is placed, below 90 degrees F. The CONTRACTOR shall not be entitled to any additional compensation on account of the foregoing requirements.

I. **Cold Weather Placement:**

1. Placement of concrete shall conform to ACI 306.1 - Cold Weather Concreting, and the following.
2. Remove all snow, ice, and frost from the surfaces, including reinforcement, against which concrete is to be placed. Before beginning concrete placement, thaw the subgrade to a minimum depth of 6 inches. All reinforcement and embedded items shall be warmed to above 32 degrees F prior to concrete placement.

3. Maintain the concrete temperature above 50 degrees F for at least 5 days after placement.

3.4 PUMPING OF CONCRETE

A. **General:** If the pumped concrete does not produce satisfactory end results, the CONTRACTOR shall discontinue the pumping operation and proceed with the placing of concrete using conventional methods.

B. **Pumping Equipment:** The pumping equipment shall have two (2) cylinders and be designed to operate with one cylinder in case the other one is not functioning. In lieu of this requirement, the CONTRACTOR may have a standby pump on the site during pumping.

C. The minimum diameter of the hose conduits shall be in accordance with ACI 304.2R.

D. Pumping equipment and hose conduits that are not functioning properly shall be replaced.

E. Aluminum conduits for conveying the concrete shall not be permitted.

F. **Field Control:** Concrete samples for slump and test cylinders will be taken at the placement end of the hose.

3.5 ORDER OF PLACING CONCRETE

A. The order of placing concrete in all parts of the WORK shall be acceptable to the ENGINEER. In order to minimize the effects of shrinkage, the concrete shall be placed in units as bounded by construction joints at the indicated locations. The placing of units shall be done by placing alternate units in a manner such that each unit placed shall have cured at least 5-days for hydraulic structures and 2-days for all other structures before the contiguous unit or units are placed, except that the corner sections of vertical walls shall not be placed until the two (2) adjacent wall panels have cured at least 10 days for hydraulic structures and 4-days

for all other structures.

B. The surface of the concrete shall be level whenever a run of concrete is stopped. To insure a level, straight joint on the exposed surface of walls, a wood strip at least ¾-inch thick shall be tacked to the forms on these surfaces. The concrete shall be carried about ½-inch above the underside of the strip. About one hour after the concrete is placed, the strip shall be removed and any irregularities in the edge formed by the strip shall be leveled with a trowel and all laitance shall be removed.

3.6 TAMPING AND VIBRATING

A. As concrete is placed in the forms or in excavations, it shall be thoroughly settled and compacted, throughout the entire depth of the layer which is being consolidated, into a dense, homogeneous mass, filling all corners and angles, thoroughly embedding the reinforcement, eliminating rock pockets, and bringing only a slight excess of water to the exposed surface of concrete. Vibrators shall be Group 3 per ACI 309, high speed power vibrators (8,000 to 12,000 rpm) of an immersion type in sufficient number and with at least one standby unit as required. Group 2 vibrators may be used only at specific locations when accepted by the ENGINEER.

B. Care shall be used in placing concrete around hydrotite waterstops. The concrete shall be carefully worked by rodding and vibrating to make sure that all air and rock pockets have been eliminated. Where flat-strip type hydrotite waterstops are placed horizontally, the concrete shall be worked under the hydrotite waterstops by hand, making sure that all air and rock pockets have been eliminated. Concrete surrounding the hydrotite waterstops shall be given additional vibration over and above that used for adjacent concrete placement to assure complete embedment of the hydrotite waterstops in the concrete.

C. Concrete in walls shall be internally vibrated and at the same time rammed, stirred or worked with suitable appliances, tamping bars, shovels or forked tools until it completely fills the forms or excavations and closes snugly against all surfaces. Subsequent layers of concrete shall not be placed until the layers previously placed have been worked thoroughly. Vibrators shall be provided in sufficient numbers, with standby units as required, to accomplish the required results within 15 minutes after concrete of the prescribed consistency is placed in the forms. The vibrating head shall not contact the surfaces of the forms. Care shall be taken not to vibrate concrete excessively or to work it in any manner that causes segregation of its constituents.

3.7 FINISHING CONCRETE SURFACES

A. **General:** Surfaces shall be free from fins, bulges, ridges, offsets, honeycombing or roughness of any kind, and shall present a finished, smooth, continuous hard surface. Allowable deviations from plumb or level and from the alignment, profiles and dimensions shown are defined as tolerances and are indicated in Part 1, above. These tolerances are to be distinguished from irregularities in finish as described herein. Aluminum finishing tools shall not be used.

B. **Formed Surfaces:** No treatment is required after form removal except for curing, repair of defective concrete, and treatment of surface defects. Where architectural finish is required, it shall be as indicated. Surface holes larger than ½-inch in diameter or deeper than ¼-inch are defined as surface defects in basins and exposed walls and shall be patched per Section 3.11 Treatment of Surface Defects.

C. **Unformed Surfaces:** After proper and adequate vibration and tamping, all unformed top surfaces of slabs, floors, walls and curbs shall be brought to a uniform surface with suitable tools. Immediately after the concrete has been screeded, it shall be treated with a liquid evaporation retardant. The retardant shall be used again after each work operation as necessary to prevent drying shrinkage cracks. The classes of finish specified for unformed concrete surfaces are designated and defined as follows:

1. Finish U1 - Sufficient leveling and screeding to produce an even, uniform surface with surface irregularities not to exceed 3/8-inch. No further special finish is required.
2. Finish U2 - After sufficient stiffening of the screeded concrete, surfaces shall be float finished with wood or metal floats or with a finishing machine using float blades. Excessive floating of surfaces while the concrete is plastic and dusting of dry cement and sand on the concrete surface to absorb excess moisture will not be permitted. Floating shall be the minimum necessary to produce a surface that is free from screed marks and is uniform in texture. Surface irregularities shall not exceed 1/4-inch. Joints and edges shall be tooled where indicated or as determined by the ENGINEER.
3. Finish U3 - After the finish U2 surface has hardened sufficiently to prevent excess of fine material from being drawn to the surface, steel troweling shall be performed with firm pressure such as will flatten the sandy texture of the floated surface and produce a dense, uniform surface free from blemishes, ripples, and trowel marks. The finish shall be smooth and free of all irregularities.
4. Finish U4 - Trowel the Finish U3 surface to remove local depressions or high points. In addition, the surface shall be given a light hairbroom finish with brooming perpendicular to drainage unless otherwise indicated. The resulting surface shall be rough enough to provide a nonskid finish.

D. **Unformed surfaces shall be finished according to the following schedule:**

UNFORMED SURFACE FINISH SCHEDULE

Area	Finish
Grade slabs and foundations to be covered with concrete or fill material	U1
Water bearing slabs with slopes 10 percent and less	U3
Water bearing slabs with slopes greater than 10 percent	U4
Slabs not water bearing	U4
Top surface of walls	U3

3.8 CURING

A. **General:** All concrete shall be cured for not less than 7 days after placing, in accordance with the methods indicated below for the different parts of the WORK.

Surface to be Cured or Damp proofed	Method
Wall sections with forms removed	1
Construction joints between footings and walls, and between floor slab and columns	2
Encasement concrete and thrust blocks	1 or 2
All concrete surfaces not specifically indicated in this paragraph	1
Floor slabs on grade in hydraulic structures	1 or 2
Slabs not on grade	1 or 2

B. **Method 1:** The surface shall be sprayed with a liquid white pigmented curing compound.

1. It shall be applied in accordance with the manufacturer's printed instructions at a maximum coverage rate of 200 square feet per gallon and in such a manner as to cover the surface with a uniform film which will seal thoroughly.
2. Where the curing compound method is used, care shall be exercised to avoid damage to the seal during the 7-day curing period. If the seal is damaged or broken before the expiration of the curing period, the break shall be repaired immediately by the application of additional curing compound over the damaged portion.
3. Wherever curing compound has been applied by mistake to surfaces against which concrete subsequently is to be placed and to which it is to adhere, compound shall be entirely removed by wet sandblasting just prior to the placing of new concrete.
4. Curing compound shall be applied as soon as the concrete has hardened enough to prevent marring on unformed surfaces and within 2 hours after removal of forms. Repairs to formed surfaces shall be made within the 2-hour period; provided, however, that any such repairs which cannot be made within the said 2-hour period shall be delayed until after the curing compound has been applied. When repairs are to be made to an area on which curing compound has been applied, the area involved shall first be wet-sandblasted to remove the curing compound.
5. At all locations where concrete is placed adjacent to a panel which has been coated with curing compound, the panel shall have curing compound

C. **Method 2:** This method applies to both walls and slabs.

1. The concrete shall be kept continuously wet by the application of water for a minimum period of at least seven (7) consecutive days beginning immediately after the concrete has reached final set or forms have been removed.
2. Until the concrete surface is covered with the curing medium, the entire surface shall be kept damp by applying water using nozzles that atomize the flow so that the surface is not marred or washed.
3. Curing blankets shall be used as a curing medium to retain the moisture during the curing period. The curing medium shall be weighted or otherwise held substantially in contact with the concrete surface to prevent being dislodged by wind or any other causes. All edges shall be continuously held in place.
4. The curing blankets and concrete shall be kept continuously wet by the use of sprinklers or other means both during and after normal working hours.
5. Immediately after the application of water has terminated at the end of the curing period, the curing medium shall be removed, any dry spots shall be rewetted and curing compound shall be immediately applied in accordance with Method 4 above.
6. The CONTRACTOR shall dispose of excess water from the curing operation to avoid damage to the work.

3.9 PROTECTION

A. The CONTRACTOR shall protect all concrete against injury until final acceptance at the CONTRACTOR's own expense and at no additional cost to the OWNER

B. Fresh concrete shall be protected from damage due to rain, hail, sleet or snow. The CONTRACTOR shall provide such protection while the concrete is still plastic and whenever precipitation is imminent or occurring.

3.10 CURING IN COLD WEATHER

A. The CONTRACTOR shall protect all concrete against injury from cold weather until final acceptance at the CONTRACTOR's own expense and at no additional cost to the OWNER.

B. Concrete cured by an application of curing compound will require no additional protection from freezing if the protection at 50 degrees F for 72 hours is obtained by means of approved insulation in contact with the forms or concrete surfaces; otherwise the concrete shall be protected against freezing temperatures for 72 hours immediately following 5 days protection at 50 degrees F. Concrete cured by water shall be protected against freezing temperatures for 3 days immediately following the 72 hours of protection at 50 degrees F.

C. Discontinuance of protection against freezing temperatures shall be such that the drop in temperature of any portion of the concrete will be gradual and will not exceed 40 degrees F in 24 hours. In the spring, when the mean daily temperature rises above 40 degrees F for more than three (3) successive days, the specified 72-hour protection at a temperature not lower than 50 degrees F may be discontinued for as long as the mean daily temperature remains above 40 degrees F; provided, that the concrete shall be protected against freezing temperatures for not less than 48 hours after placement.

D. Where artificial heat is employed, special care shall be taken to prevent the concrete from drying. Use of un-vented heaters will be permitted only when unformed surfaces of concrete adjacent to the heaters are protected for the first 24 hours from an excessive carbon dioxide atmosphere by application of curing compound; provided, that the use of curing compound for such surfaces is otherwise permitted by these Specifications.

3.11 TREATMENT OF SURFACE DEFECTS

A. As soon as forms are removed, all exposed surfaces shall be carefully examined and any irregularities shall be immediately patched or ground in a satisfactory manner in order to secure a smooth, uniform and continuous surface. Plastering or coating of surfaces to be smoothed will not be permitted. No repairs shall be made until after inspection by the ENGINEER. In no case will extensive patching of honeycombed concrete be permitted. Concrete containing minor voids, holes, honeycombing, or similar depression defects shall be repaired as indicated below. Concrete containing extensive voids, holes, honeycombing, or similar depression defects shall be completely removed and replaced. All repairs and replacements herein required shall be promptly executed at no increased cost to the OWNER.

B. Defective surfaces to be repaired shall be cut back from true line a minimum depth of ½-inch over the entire area. Feathered edges will not be permitted. Where chipping or cutting tools are not required in order to deepen the area properly, the surface shall be prepared for bonding by the removal of all laitance or soft material, plus not less than $^{1}/_{32}$-inch depth of the surface film from all hard portions by means of an efficient sandblast. After cutting and sandblasting, the surface shall be wetted sufficiently in advance of shooting with shotcrete or with cement mortar so that while the repair material is being applied, the surfaces underneath will remain moist but not so wet as to overcome the suction upon which a good bond depends. The material used for repair proposed shall consist of a mixture of one sack of cement to 3-cubic feet of sand. For exposed walls, the cement shall contain such a proportion of Atlas white Portland cement as is required to make the color of the patch match the color of the surrounding concrete. In hydraulic structures the material used for repair shall be hydraulic cement as defined in this Section under Products.

C. Holes left by tie-rod cones shall be rubber stopped and grouted. Holes then shall be repaired in an approved manner with dry-packed cement grout. Holes left by form-tying devices having a rectangular cross-section and other imperfections having a depth greater than their least surface dimension shall not be reamed but shall be repaired in an approved manner with dry-packed cement grout.

D. All repairs shall be built up and shaped in such a manner that the completed work will conform to the requirements of this Section, as applicable, using approved methods which will not disturb the bond, cause sagging, or cause horizontal fractures. Surfaces of repairs shall receive the same kind and amount of curing treatment as required for the concrete in the repaired section.

E. Prior to filling any structure with water, all cracks that may have developed shall be "vee'd" as indicated in specs or in the field and filled with sealant conforming to the requirements of Section 03290 - Joints in Concrete. This repair method shall be done on the water bearing face of members. Prior to backfilling, faces of members in contact with fill, which are not covered with a waterproofing membrane shall also have cracks repaired as indicated herein.

3.12 PATCHING HOLES IN CONCRETE

A. **Patching Small Holes:**

1. Holes which are less than 12 inches in the least dimension and extend completely through concrete members shall be filled.
2. Small holes in members which are water-bearing or in contact with soil or other fill material shall be filled with non-shrink grout or hydraulic cement in wet tanks. Where a face of the member is exposed to view, the non-shrink grout shall be held back 2 inches from the finished surface. The remaining 2 inches shall then be patched according to the Paragraph entitled "Treatment of Surface Defects."
3. Small holes through all other concrete members shall be filled with non-shrink grout or hydraulic cement, with exposed faces treated as above.

B. **Patching Large Holes:**

1. Holes which are larger than 12 inches in the least dimension shall have a keyway chipped into the edge of the opening all around, unless a formed keyway exists. The holes shall then be filled with concrete as indicated herein.
2. Holes which are larger than 24 inches in the least dimension and which do not have reinforcing steel extending from the existing concrete, shall have reinforcing steel set in grout in drilled holes. The reinforcing added shall match the reinforcing in the existing wall unless indicated otherwise.
3. Large holes in members which are water bearing or in contact with soil or other fill shall have a bentonite type hydrotite waterstop material placed around the perimeter of the hole in accordance with Section 03290 - Joints in Concrete, unless there is an existing hydrotite waterstop in place.

3.13 CARE AND REPAIR OF CONCRETE

A. The CONTRACTOR shall protect all concrete against injury or damage from excessive heat, lack of moisture, overstress or any other cause until final acceptance. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damaging the surface. Any concrete found to be damaged, or which may have been originally defective, or which becomes defective at any time prior to the final acceptance of the completed WORK, or which departs from the established line or grade, or which, for any other reason, does not conform to the requirements of the Contract Documents, shall be satisfactorily repaired or removed and replaced with acceptable concrete at no additional cost to the OWNER.

- END OF SECTION -

SECTION 03315
GROUT

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. Provide and place grout in accordance with the Contract Documents.

B. **Section Includes:**

1. Concrete Mortar
2. Grout
3. Drypack Mortar
4. Non-shrink Grout.
5. Epoxy grout.
6. Non-shrink epoxy grout.

C. **Related Sections:**

1. Section 03300 – Cast in Place Concrete.
2. Section 03931 – Epoxy Injection

1.2 REFERENCES

A. **American Society for Testing and Materials (ASTM):**

1. C 109 – Test Method for Compressive Strength of Hydraulic Cement Mortars (using 2 inch or 50 millimeter cube specimens).
2. C 230 – Standard Specification For Flow Table For Use In Tests Of Hydraulic Cement.
3. C 531 – Test Method for Liner Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing and Polymer Concretes.
4. C 579 – Test Method for Compressive Strength of Chemical-Resistant Mortars and Monolithic Surfacing.
5. C 827 – Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures.
6. C 939 – Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method).
7. C 1090 – Test Method for Measuring Change in Height of Cylindrical Specimens from Hydraulic-Cement Grout.
8. C 1107 – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (non-shrink).
9. C 1181 – Test Methods for Compressive Creep of Chemical-Resistant Polymer Machinery Grouts.

1.3 SUBMITTALS

A. Furnish submittals in accordance with Section 01300 - Submittals.

B. **Grout:** Submit manufacturer's Literature and certified test data prior to installation of any grout mixes.

1.4 DELIVERY, STORAGE, AND HANDLING

A. All materials shall be delivered to the jobsite in their original, unopened packages or containers, clearly labeled with the manufacturer's product identification and printed instructions.

B. All materials shall be stored in a cool dry place and in accordance with the manufacturer's recommendations.

C. All materials shall be handled in accordance with the manufacturer's instructions.

1.5 PROJECT/SITE CONDITIONS

A. Refer to manufacturer's literature or contact the manufacturer for any special physical or environmental limitations that may be required for use of products.

1.6 WARRANTIES

A. Non-shrink Grout: The manufacturer shall warranty that the non-shrink grout will never go below its initial placement volume when tested in accordance with ASTM C 1107.

B. Non-shrink Epoxy Grout: The manufacturer shall warranty that the non-shrink epoxy grout will show negligible shrinkage or expansion when tested in accordance with ASTM C 531.

PART 2 – PRODUCTS

2.1 MATERIALS

A. **Concrete Mortar:**

1. General: Consist of concrete mixture with coarse aggregate removed and water quantity adjusted as required.
2. At Exposed Concrete Surfaces Not to Be Painted or Submerged in Water: White Cement.

B. **Grout:** Consist of mixture of Portland cement and sand.

C. **Dry-pack:**

1. Mortar consists of mixture of Portland cement and sand.
2. Hydraulic Cement Manufacturers

    a. Aqua Plug
    b. Unitex Hydraulic Cement
    c. Thoro Water Plug

D. **Non-shrink Grout:**

1. Manufacturers: One of the following or equal:

    a. Five Star Products, Inc., Fairfield, CT, Five Star Grout.
    b. Master Builders, Inc., Cleveland, OH, Masterflow 928.
    c. L&M Construction Chemicals, Inc., Omaha, NE, CRYSTEX

2. Non-shrink grout shall be a proportioned and prepackaged cement-based mixture. It shall contain no metallic particles such as aluminum powder and no metallic aggregate such as iron filings. It shall require only the addition of potable water.
3. Potable water for pre-soaking, mixing, and curing shall be clean and free of oils, acids, alkalies,

organics, and any other deleterious matter.

4. Bleeding: Non-shrink grout shall be free from the emergence of mixing water from within or the presence of water on its surface.
5. Non-shrink grout shall be in accordance with ASTM C 1107.
6. Consistency: Non-shrink grout shall remain at a minimum flowable consistency for at least 45 minutes after mixing at 45 degrees Fahrenheit to 90 degrees Fahrenheit when tested in accordance with ASTM C 230. If at a fluid consistency, it shall be verified in accordance with ASTM C 939.
7. Dimensional Stability (height change): Non-shrink grout shall be in accordance with ASTM C 1107, volume-adjusting Grade B or C at 45 degrees to 90 degrees. It shall show 90 percent or greater bearing area under bases or baseplates.
8. Compressive Strength: Non-shrink grout shall show minimum compressive strengths at 45 degrees Fahrenheit to 90 degrees Fahrenheit in accordance with ASTM C 1107 for various periods from the time of placement, including 5,000 pounds per square inch at 28 days when tested in accordance with ASTM C 109 as modified by C 1107.

E. **Epoxy Grout:**

1. Consist of mixture of epoxy and sand.
2. Sand: Clean, bagged, graded, and kiln dried silica sand.

F. **Non-shrink Epoxy Grout:**

1. Manufacturers: One of the following or equal:

   a. Five Star Products, Inc., Fairfield, CT, Five Star Epoxy Grout.
   b. Master Builders, Inc., Cleveland, OH, Masterflow 648 CP Plus.
   c. L&M Construction Chemicals, Inc., Omaha, NE, EPOGROUT.

2. Non-shrink epoxy grout shall be a 100 percent solids, pre-measured, prepackaged system containing a two-component thermosetting epoxy resin and inert aggregate
3. Consistency: Non-shrink epoxy grout shall maintain a flowable consistency for at least 45 minutes at 70 degrees Fahrenheit.
4. Dimensional Stability (height change):

   a. Non-shrink epoxy grout shall have negligible shrinkage or expansion (less than 0.0006 in/in) when tested in accordance with ASTM C 531.

5. Compressive Strength: Non-shrink epoxy grout shall show a minimum compressive strength of 10,000 pounds per square inch at 24 hours and 14,000 pounds per square inch at 7 days when tested in accordance with ASTM C 579, Method B.
6. Compressive Creep: The compressive creep for non-shrink epoxy grout shall not exceed 0.0027 in/in when tested under a 400 pounds per square inch constant load at 140 degrees Fahrenheit in accordance with ASTM C 1181.
7. Thermal Capability: The coefficient of thermal expansion for non-shrink epoxy grout shall not exceed 0.000018 inches per inch per degree Fahrenheit when tested under ASTM C 531, Method B.

2.2 MIXES

A. **Concrete Mortar Mix:**

1. Use water-cement ratio that is no more than that specified for concrete being repaired.
2. At Exposed Concrete Surfaces Not to Be Painted or Submerged in Water: Use sufficient white

cement to make color of finished patch match that of surrounding concrete.

B. **Grout Mix:**

1. For Concrete Repair: Mix in same proportions used for concrete being repaired, with only sufficient water to give required consistency for spreading.
2. For Spreading over the Surfaces of Construction or Cold Joints: Mix with no more water used than allowed by water-cement ratio specified for concrete.
3. For Other Applications: Mix in proportions by weight of one part cement to four parts of concrete sand.

C. **Dry-pack Mortar and Hydraulic Cement Mix:** Use only enough water so that resulting mortar will crumble to touch after being formed into a ball by hand.

D. **Non-shrink Grout:** Mix in accordance with manufacturer's installation instructions such that resulting mix has fluid or flowable consistency and is suitable for placing by pouring.

E. **Epoxy grout:** Mix in accordance with manufacturer's installation instructions for mixing.

F. **Non-shrink Epoxy Grout:** Mix in accordance with manufacturer's installation instructions.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Inspect concrete surfaces to receive grout or mortar and verify that they are free of ice, frost, dirt, grease, oil, curing compounds, paints, impregnations and all loose material or foreign matter likely to affect the bond or performance of grout or mortar.

B. Inspect baseplate and anchor systems for rust, oil, and other deleterious substances that may affect the bond or performance of grout.

C. Confirm that newly placed concrete has been cured sufficiently to attain its design strength and limit further shrinkage.

D. Verify that temperature of cementitious or epoxy grout does not exceed manufacturer's recommendations.

3.2 PREPARATION

A. **Surface Preparation:**

1. Roughen all concrete surfaces by heavy sandblasting, chipping, or other mechanical means to assure bond. Loose or broken concrete shall be removed.
2. All grease, oil, dirt, curing compounds, laitance, and other deleterious materials that may affect bond that were identified in the inspection process shall be completely removed from concrete and bottoms of baseplates. All metal surfaces should have a 2 to 3 mil peak-to-valley profile for epoxy grouts.
3. For cementitious mortars and grouts, concrete surfaces shall be saturated surface dry. Any standing water shall be removed prior to placing grouts.
4. For epoxy grouts, do not wet concrete surfaces with water. Instead, where required, wet surfaces with epoxy for horizontal work or epoxy gel for vertical or overhead work prior to placing epoxy grouts.

B. **Forms and Headboxes for Grouts (Cementitious or Epoxy):**

1. Forms for grouts shall be built of material with adequate strength to withstand the placement of grouts.
2. Forms must be rigid and liquid tight. All cracks and joints shall be caulked with an elastomeric sealant. All forms shall be lined with polyethylene for easy grout release. Forms carefully waxed with two coats of heavy-duty paste wax shall also be acceptable.
2. Forms shall be 4 to 6 inches higher than the baseplate on one side of the baseplate configuration when using head pressure for placement.
3. A sufficient number of headboxes shall be built to facilitate placement of grouts.
4. Air relief holes a minimum 1/8 inch in diameter shall be provided when required by a baseplate configuration to avoid entrapping air underneath.

3.3 APPLICATION

A. **Cement Mortar and Grout:**

1. For Defective Concrete Repair:

   a. Filling: Filling of voids around items through the concrete.
   b. Grout Spreading: Spread over construction joints, cold joints, and similar type items.

2. Concrete Surfaces: Apply epoxy bonding agent to clean, roughened, and dry surfaces before placing mortar or grout.

3. Placing:

   a. Exercise particular care in placing Portland cement mortar or grout since they are both required to furnish structural strength or impermeable water seal or both.
   b. Do not use cement mortar or grout that has not been placed within 30 minutes after mixing.

B. **Epoxy Grout:**

1. Apply in accordance with manufacturer's installation instructions.
2. Use where specified herein or where indicated on the Drawings.

3.4 PLACEMENT

A. The CONTRACTOR shall make arrangements to have a grout manufacturer's representative present for a preconstruction meeting and during the initial grout placement. Grout shall only be installed after the final equipment alignment is correct and accepted by the ENGINEER.

1. Grouts shall be mixed in accordance with the manufacturer's recommendations.
2. A mortar mixer with moving paddles shall be used for mixing grouts. For cementitious grouts, pre-wet the mixer and empty out excess water before beginning mixing.
3. Cementitious Grouts:

   a. Non-shrink cementitious grout shall be added to a pre-measured amount of water that does not exceed the manufacturer's maximum recommended water content.
   b. Mix cementitious grouts per manufacturer's instructions for uniform consistency.
   c. Grouts may be drypacked, flowed, or pumped into place. All baseplate grouting shall take place from one side of a baseplate to the other to avoid trapping air. Do not overwork grouts.

d. Do not retemper grout by adding more water after stiffening.
e. Hydrostatic head pressure shall be maintained by keeping the level of the grout in the headbox above the bottom of the baseplate. The headbox should be filled to maximum level and the grout worked down to top of baseplate.

4. Epoxy Grouts:

a. Epoxy grouts shall be mixed in complete units. Do not vary the ratio if components or add solvent to change the consistency of the mix.
b. Pour the hardener into the resin and mix for at least one minute and until each mixture is uniform in color. Pour the chemical components into the mortar mixer wheelbarrow and add the aggregate. Mix until aggregate is uniformly wetted. Overmixing will cause air entrapment in the mix.
c. All epoxy grout shall be flowed into place using a headbox. All grouting shall take place from one side of a baseplate to the other in a continuous flow to avoid trapping air.
d. Hydrostatic head pressure shall be maintained by keeping the level of grout in headboxes above the bottom of baseplates. Headboxes shall be filled to the maximum level and grout worked down to the bottom of the baseplates.
e. Epoxy grouts shall not be cut back after setting. The final level of grout will be as installed with all chamfer edges built into the formwork.

3.5 CURING

A. **Cementitious Grouts:**

1. Grouts must be cut back to the lower edge of baseplates after reaching initial set. Provide a 45 degree angle cut back.
2. Clean equipment and tools as recommended by the grout manufacturer.
3. Cure Grouts in accordance with the manufacturer's specifications and recommendations. Keep grout moist for a minimum of 3 days. The method needed to protect grouts will depend on temperature, humidity, and wind. Wet burlap, a soaker hose, sun shading, ponding and in extreme conditions, a combination of methods shall be employed.
4. Grouts shall be maintained above 40 degrees Fahrenheit until they have attained a compressive strength of 3,000 pounds per square inch or above 70 degrees Fahrenheit for a minimum of 24 hours to avoid damage from subsequent freezing.

B. **Epoxy Grouts:**

1. Cure grouts in accordance with manufacturer's specifications and recommendations. Do not wet cure epoxy grouts.
2. Consult the manufacturer for appropriate cure schedule. In no case should any surface in contact with grout be allowed to fall below 50 degrees Fahrenheit for a minimum of 48 hours after placement.
3. Equipment and tools shall be cleaned immediately with a strong liquid detergent and water solution before grout hardens.

3.6 FIELD QUALITY CONTROL

A. Non-shrink grouts shall be tested for 84 hour compressive strength in accordance with ASTM C 109.

B. Non-shrink grouts shall be tested for 24 hour compressive strength in accordance with ASTM C 579 (Method B).

- END OF SECTION -

SECTION 03931
EPOXY INJECTION SYSTEM

PART 1 – GENERAL

1.1 SUMMARY

A. **Section Includes:** Epoxy injection system.

1.2 REFERENCES

A. **American Society for Testing and Materials (ASTM):**

1. D 638 - Text Method for Tensile Properties of Plastics.
2. D 695 - Test Method for Compressive Properties of Rigid Plastics.
3. D 790 - Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

1.3 SUBMITTALS

A. Furnish submittals in accordance with Section 01300 - Submittals.

B. **Product Data:** Submit manufacturer's data completely describing epoxy injection system materials.

C. **Quality Control Submittals:**

1. Certificates of Compliance.
2. Manufacturer's Instructions.

PART 2 – PRODUCTS

2.1 MATERIALS

A. **Manufacturers:** One of the following or equal:

1. Master Builders, Inc., Concressive Standard LVI.
2. Sika Chemical Corp.'s, Sikadur 35, Hi-Mod LV.

B. **Epoxy:** Provide epoxy materials that are new and use them within shelf life limitations set forth by manufacturer. Water-insensitive 2 part type low viscosity epoxy adhesive material containing 100 percent solids and meeting or exceeding following characteristics when tested in accordance with standards specified:

Physical Characteristic	Test Method	Required Results
Tensile Strength	ASTM D 638	8,000 pounds per square inch at 14 days and 77 degrees Fahrenheit cure.
Flexure Strength	ASTM D 790	11,000 pounds per square inch at 14 days and 77 degrees Fahrenheit cure.
Compressive Strength	ASTM D 695	16,000 pounds per square inch at 24 hours and 77 degrees Fahrenheit cure.
Bond Strength	–	Concrete shall fail before failure of epoxy.
Gel Time In 5-Mil Film	–	Four hours maximum at 77 degrees Fahrenheit.
Elongation	ASTM D 638	1 percent minimum at 14 days and 77 degrees

		Fahrenheit.

2.2 EQUIPMENT

A. **Pump Unit:**

1 Furnish unit to be used for injection that is positive displacement type with interlock to provide in-line mixing and metering system for 2 component epoxy.
2. Furnish pressure hoses and injection nozzle of such design as to allow proper mixing of 2 components of epoxy.
3. Presence of standby injection unit may be required.

2.3 MIXES

A. **Epoxy Injection System Materials:**

1. Mix epoxy in accordance with manufacturer's installation instructions.
2. Do not use solvents to thin epoxy system materials introduced into cracks or joints.

PART 3 – EXECUTION

3.1 PREPARATION

A. **Surface Preparation:**

1. Epoxy Injection System:

a. General: Before processing, sweep or clean area in vicinity of crack location to receive epoxy and leave in generally clean condition.
b. Joints to Receive Epoxy: Clean in manner such that joints are free from dirt, laitance, and other loose matter.

3.2 INSTALLATION

A. Install and cure epoxy materials in accordance with manufacturer's installation instructions.

B. Perform and conduct work of this Section in neat orderly manner.

C. **Epoxy Injection System:**

1. Apply adequate surface seal to crack or joint to prevent escape of epoxy.
2. Establish entry points at distance along seal not less than thickness of cracked member.
3. Force epoxy into crack at first port with sufficient pressure to advance epoxy to adjacent port.
4. Seal original port and shift entry to port at which epoxy appears.
5. Continue this manner of port-to-port injection until each joint has been injected for its entire length.
6. For small amounts, or where excessive grout pressure developed by pump unit might further damage structure, premixed material and hand caulking gun may be used if acceptable to the ENGINEER.
7. Seal ports, including adjacent locations where epoxy seepage occurs, as necessary to prevent drips or run out.

- END OF SECTION -

SECTION 05120
STRUCTURAL STEEL

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. Provide structural steel for building construction including sub-framing units, which are part of the general framing system. Include anchors, bases, bearing plates, bracing, lintels when part of structural framing and detail fittings.

B. Modify existing structural steel systems and components to accommodate remodeling and new work.

1.2 SUBMITTALS

A. Submittals shall be furnished in accordance with Section 01300 – Submittals.

1.3 QUALITY ASSURANCE

A. Comply with Governing Codes and Regulations. Provide products of acceptable manufacturers. Use experienced installers. Deliver, handle and store materials in accordance with manufacturer's instructions.

PART 2 – PRODUCTS

2.1 MATERIALS

A. **Steel shapes plates and bars:** ASTM A 36 or ASTM A 572, Grade 50

B. **Steel pipe:** ASTM A 53

C. **Anchor bolts:** ASTM A 307

D. **High strength threaded fasteners:** ASTM A 325

E. Non-metallic shrinkage resistant grout; Euclid Euco NS, L&M Crystex, Sonneborn Sonnegrout, Five Star Products, or ENGINEER approved equal. Compressive strength suited for Project Requirements.

F. Shop finish for structural steel in accordance to Section 09900 – Painting.

G. **Galvanized lintels:** Hot dip galvanized ASTM A 123

H. **Welding:** AWS D1.1

PART 3 – EXECUTION

3.1 INSTALLATION

A. Comply with AISC Codes and Specifications and with AWS "Structural Welding Code."

B. Employ a registered ENGINEER to check elevations and plumb and level tolerances; certify that installed work is within AISC Standards. Testing/inspection agency may be employed to inspect welded and bolted connections.

C. Touch-up field welds and abraded areas in accordance with Section 09900 - Painting.

D. Provide all necessary bolt, fasteners, anchors, etc. to install or construct this scope of the work.

- END OF SECTION -

SECTION 05500
MISCELLANEOUS METALS, FASTENERS, AND SPECIAL FINISHES

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. Provide all labor, materials, bolts, fasteners, equipment and service necessary for fabrication and erection of structural steel and aluminum and for fabrication and installation of miscellaneous non-ferrous metals in accordance with the Contract Documents and not specifically included under other Sections of these Specifications.

1. Erection
2. Shop and Erection Drawings
3. Shop Painting
4. Galvanizing
5. Aluminum Work Protection
6. Cleaning Aluminum Work
7. Miscellaneous Items
8. Loose Lintels
9 Sleeves and Inserts
10 Aluminum Pipe Railing
11. Plate Covers and Frames
12. Guard Chains
13. Lifting Hooks
14. Cast Iron Wheel Guard
15. Cast Aluminum Nosings
16. Floor Hatches and Frames
17. Access Doors

1.2 REFERENCES

A. **All work under this Section shall be governed by:**

1. Specifications for the design, fabrication and erection of structural steel for buildings – American Institute of Steel Construction, current edition.
2. Aluminum Construction Manual, Section 1, Specifications for Aluminum Structures – The Aluminum Association.
3. All welding shall conform to the latest code of the American Welding Society.
4. ASTM A 276
5. ASTM A 325
6. ASTM F 593, 294
7. Federal Specification FF-S-325
8. ASTM A 48
9. Federal Specification TT-V-51F
10. ANSI B94.12
11. ASTM A 12, A 153, A 384, A 593 and A 780
12. SSPC SP-1, SP-2, SP3, SP-7

1.3 SUBMITTALS

A. Submittals shall be furnished in accordance with Section 01300 - Submittals.

B. As required by the Specifications, submit for review completely detailed and certified shop and erection drawings of the miscellaneous metal work. All Coatings or other protection against corrosion to be applied at the shop or in the field shall be indicated on these drawings. The shop drawings for aluminum work shall show the alloys and tempers to be used, and the finish, if any to be applied.

C. Shop drawings, giving complete information necessary for fabrication, layout and installation of metal work shall be submitted to the ENGINEER for review prior to fabrication.

D. Preparation of shop drawings for fabricated metal items shall be coordinated with the manufacturers, of various equipment in order to comply with details, locations, openings and arrangements required by the manufacturers, of various equipment in order to comply with details, locations, openings and arrangements, required by the manufacturers.

E. Field measurements shall be made to verify all dimensions in the field, which may affect installation of work before shop drawings are made and/or fabrication is performed.

1.4 QUALITY ASSURANCE

A. The design, detail and workmanship of steel plates and structural steel shall conform to the AISC Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.

B. Where welding is permitted or required, it shall conform to the current requirements of the American Welding Society for the type of work in question.

C. Aluminum work shall be fabricated in a shop where the quality of work is in accordance with the highest standards for work of this type. All work shall be executed by mechanics skilled in the fabrication of aluminum, and shall be true to detail with sharp, clean profiles, fitted with proper joints and intersections and with finishes as specified.

D. All miscellaneous metal work shall be formed to shape and size with sharp lines and angles. Shearing and punching shall leave clean true lines and surfaces.

1.5 RESPONSIBILITY FOR DIMENSIONS

A. The general design and dimensions of the miscellaneous metal work are indicated on the Drawings, correctness of the details and dimensions of the finished articles is required. Verification of conditions at the job before fabrication and coordination of the work with that of all other trades to prevent interference.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Steel plated and structural steel shapes shall conform to ASTM Standard Specification for Structural Steel, Designation A36.

B. Sheet steel shall be cold rolled or hot rolled carbon sheet steel conforming to ASTM Standard Specification for Steel, Carbon, Cold Rolled Sheet, Commercial Quality, Designation A36 or AST ASTM Standard Specification for Steel, Carbon (0.15 maximum, percent), Hot Rolled Sheet and Strip, Commercial Quality, Designation A569, as appropriate.

C. Steel pipe shall conform to ASTM Standard Specifications for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless, Designation A53.

D. Stainless steel shall be Type 304 unless otherwise indicated or specified in the Contract Documents.

E. Aluminum work shall be fabricated of plates, rolled or extruded shapes, sheets or casting conforming (unless otherwise permitted or indicated) to the following alloy and temper designations of the Aluminum Association:

1. Structural rolled or extruded shapes 6061-T6.
2. Extruded shapes 6063-T5.
3. Plates 6061-T6.
4. Gratings (bearing bars) 6061-T6 (crimp bars) 6063-T6.
5. Castings 214.
6. Sheets 3003-F.
7. Bolts and nuts 2024-T4.
8. Pipe Railing 6063-T6.

2.2 STEEL

A. Structural steel shall conform to the requirements of ASTM A-36. Structural tubing, where used, shall conform to the requirements of ASTM A-500, Grade B, and the ends of the tubing shall be properly sealed to protect the internal surfaces. Steel anchor bolts shall be ASTM A-36 hot rolled threaded rod or bar stock, except where stainless steel is indicated on the Drawings.

B. Structural steel members as required shall conform to ASTM Standard shapes.

C. Base and bearing plates shall be provided where necessary to provide maximum bearing value of not more than 200 psi on solid concrete masonry units not more than 750 psi on concrete and shall be grouted in place.

D. Steel lintels shall be provided for all square head openings in masonry where shown and where other lintels are not indicated on the Drawings. Lengths of bearing at each end of lintels shall be not less than 1 inch per foot of span, but in no case less than 8 inches shall be increased or the lintels shall be fitted with bearing plates as required to provide unit pressures in pounds per square inch of not more than 200 on solid concrete masonry units and 625 on concrete. All new steel lintels shall be shop primed and ready to receive coatings as specified under Section 09900 – Painting. Finish coats are specified in Section 09800 – Special Coatings.

2.3 SHOP PAINTING

A. Painting of miscellaneous ferrous metal work is specified under Section 09800 – Special Coatings.

2.4 GALVANIZING

A. Items of miscellaneous iron work and steel work indicated on the Drawings or specified to be galvanized shall be zinc coated by the hot dip process in conformity with ASTM Standard Specification for Zinc (hot galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip, Designation A123-78; or ASTM Standard Specifications for Zinc Coating (hot-dip) on Iron and Steel Hardware, Designation A153-78, as appropriate. Galvanizing is specified under Article 3.04, "Hot-Dip Galvanizing."

2.5 ALUMINUM

A. All structural and miscellaneous aluminum shall be Alloy 6061 (Alloy 6063 for extrusions), Temper T6, unless otherwise noted, indicated or accepted by the Owner. Where welding is necessary in fabrication, is shall be done in conformance with Section 7 "Welded Construction" of Specification for Aluminum Structures, referenced hereinbefore.

2.6 ALUMINUM WORK PROTECTION

A. Aluminum surfaces which after erection would otherwise be in contact with concrete or brick masonry or with mortar, shall be protected from contact therewith by a coat of bitumastic super service black manufactured by the Koppers Company, Inc. Pittsburgh, PA; Tarmastic 100 manufactured by Porter Coating Division, Porter Paint Company, North Kansas City, MO; or an acceptable equivalent product. Areas where the paint has been damaged by abrasion or other cause shall be cleaned and repainted as directed so that the aluminum will have a complete protective paint film when brought into contact with the material against which it is being protected. Before application of coating, the surface shall be cleaned of all dirt, heavy deposits of grease or oil and other foreign substances and shall be immersed in or swabbed with an acceptable solvent. Next the surfaces shall be rinsed with clear water and thoroughly dried.

B. Attention of the Specifications in regard to protection against electrolysis where aluminum is to be used in conjunction with dissimilar metals is required.

C. Where a shop coating of methacrylate lacquer has been specified on aluminum work to protect the surface from stain, the protective coating of lacquer worn off during handling or erection shall be replaced in the field by a new coating of lacquer of the same type.

D. During construction, care shall be taken to prevent damage to the aluminum work from splashing or the accumulation of paint, concrete, mortar, or other similar materials.

2.7 STAINLESS STEEL

A. Stainless steel shapes shall be ANSI Type 304 or 316 in accordance with ASTM A-276. Miscellaneous bar stock products such as pipe straps shall be 300 Series stainless steel. Anchor bolts, nuts and washers shall be ANSI Series 300 stainless steel.

2.8 FASTENERS

A. **Bolts, Nuts and Washers:**

1. Structural bolts shall be ANSI Type 300 Series stainless steel in accordance with ASTM F-593, with ASTM F-594 nuts. All bolts shall have hexagonal heads.
2. Anchors and bolts including nuts and washers shall be provided where necessary for securing the work in place. Sizes, types and spacings of anchors and bolts not indicated or specified otherwise shall be as necessary for their purposes. Anchor bolts and anchors for the erection of structural steel shall be shall be stainless steel Type 316.

B. **Expansion Anchors (In Concrete):**

1. Expansion anchors shall be of three (3) types:

   a. Stainless steel wedge type.
   b. Self drilling plated type with stainless steel bolt and stainless steel washer.

   Type of expansion anchor desired shall be noted on Drawings.

2. Stainless steel wedge type anchors shall be ITW Ramset/Red Head or ENGINEER approved equal of Type 316 stainless steel. Anchors shall meet or exceed latest Government GSA Federal Specifications FF-S-325, Group II, Type 4, Class 1. Anchor shall be used with 300 series stainless steel bolt and washer.
3. Self-drilling plated anchors shall be ITW Ramset/Red Head of ENGINEER approved equal. Anchors shall meet or exceed latest Government GSA Federal Specification FF-S-325, Group III, Type 1, Self-

drilling anchors shall be electro-deposited zinc plated and chromate dipped, to meet or exceed the requirements of the latest Federal Specification QQ-Z-325, Type II, Class 3. Cutting teeth shall have minimum hardness of 82 Rockwell A scale.

4. Steel expansion anchors shall be installed in accordance with manufacturer's recommendations.
5. Self-drilling expansion anchors shall be installed in accordance with manufacturer's recommendations. To insure full development strength, all self-drilling expansion anchors shall be expanded over the plug in the final set, by using a bolt screwed into the female threads and impacted by hand with a suitable hammer. The final set shall not be accomplished by using the drilling tool.
6. After installation, pull-out tests by the anchor manufacturer's representative may be requested by the ENGINEER. If so, the ENGINEER will specify the number and location of the tests.

2.9 MISCELLANEOUS ITEMS

A. Items of miscellaneous metal work not particularly specified hereinafter shall be of the shape, size, materials and details indicated on the Drawings or suitable for the purpose intended.

2.10 LOOSE LINTELS

A. Furnish all loose lintels as indicated on the Drawings or required by the Work. The loose lintels shall be fabricated from structural steel shapes and plates. All loose lintels shall be shop primed and ready to receive coatings as specified under Section 09900 - Painting.

2.11 SLEEVES AND INSERTS

A. Attention is directed to the requirements of the Specifications regarding sleeves and inserts.

2.12 ALUMINUM PIPE RAILING

A. Reference Section 05501.

B. The aluminum pipe railing shall be the product of company normally engaged in the manufacture of pipe railing. Railing shall be shop assembled in lengths not to exceed 24-feet for field erection.

C. Handrails and stair rails shall be designed to withstand a 200 pound concentrated load applied in any direction at any point on the top rail. Handrails and stair rails shall also be designed to withstand a load of 50 pounds per foot applied horizontally to the top rail. The 200 pound load will not be applied simultaneously with the 50 pounds per foot load. In addition, the handrails shall be designed to withstand a load of 100 pounds per foot horizontal load. The 100 pounds per foot vertical load does not apply to stair rails.

D. The manufacturer shall submit calculations to the ENGINEER for approval. Testing of base castings or base extrusions by an independent lab or manufacturer's lab (if manufacturer's lab meets the requirements of the Aluminum Association) will be an acceptable substitute for calculations. Calculations will be required for approval of all other design aspects.

E. Post spacing shall be a maximum of 8-feet 0 inches, unless noted otherwise. Posts and railings shall be a minimum of 1½ inches Schedule 40 aluminum pipe alloy 6063-T6, ASTM B 429 or ASTM B 221. The handrail manufacturer shall show that their posts are of adequate strength, the manufacturer may reduce the post spacing or add reinforcing dowels or may do both in order to meeting loading requirements.

F. The handrail shall be made of pipes joined together with component fittings. Samples of all components, bases, toe plate and pipe must be submitted for approval. Components that are glued at the joints will not be acceptable. Handrail and components shall be Kee Clamp, Inc., Golden Railings, Speed-Rail, or approval equal.

G. Posts shall not interrupt the continuation of the top rail at any point along the railing, including corners and end terminators.

H. The midrail at a corner return shall be able to withstand a 200 pound load without loosening.

I. Expansion bolts shall be spaced 10 diameters apart and 5-diameter edge distance for not reduction in pullout strength. A safety factor of four shall be used on expansion bolt pullout values published by the manufacturer.

J. Toe plate shall conform to OSHA Standards. Toe plate shall be a minimum of 4 inches high and shall be an extrusion that attaches to the posts with clamps, which allow for expansions and contraction between posts. Toe plates shall be set ¼-inch above the walking surface. Toe plates shall be provided on handrails as required by OSHA and/or as shown on Drawings. Toe plates shall be shipped loose in stock lengths with pre-manufactured corners for field installation.

K. Openings in the railing shall be guarded by a self-closing gate. Safety chains shall not be used unless specifically shown on the Drawings.

L. Finish shall be Aluminum Association M10-C22-A41 (215-R1). The pipe shall be plastic wrapped. The plastic wrap is to be removed after erection.

M. Aluminum surfaces in contact with concrete, grout or dissimilar metals will be protected with a coat of bituminous paint, (two (2) coats of Federal Specification TT-V51F Asphalt Varnish), mylar isolators, or other approved material.

2.13 PLATE COVERS AND FRAMES

A. The plate covers and frames shall be the sizes indicated on the Drawings. The frames shall be aluminum angles of the sizes indicated with welded strap anchors for securing the frames in the concrete. The frames shall have mitered corners with welded joints ground smooth where exposed.

B. The covers shall be ¼-inch thick aluminum tread plate having an acceptable nonskid surface and reinforced with aluminum bars welded to the underside of the cover in accordance with the details. Plate covers shall be capable of supporting a uniform superimposed load of 100 psf for the span with a deflection of less than ¼-inch based on allowable fiber stress of 16,000 psi. The covers shall be made to fit neatly and accurately in the frames.

C. Hinged covers shall be furnished with heavy-duty stainless steel, plain bearing hinges with stainless steel pins. The hinges shall be fastened to the covers and frames with stainless steel machine screws. The hinged covers shall be provided with flush lift handles fabricated from ½-inch diameter aluminum rod, alloy 6061-T6511.

D. A single leaf of hinged plate covers shall be no greater than 3 -feet x 5-feet in size.

E. Removable plate covers shall have 1-inch diameters finger holes to facilitate removal. All edges of holes cut in the plate covers shall be ground smooth.

F. Removable plate covers shall be no greater than 14 square feet in size with the longer dimension no greater than 7-feet.

G. Gasket plate covers shall have continuous compressible neoprene seals between the cover and the frame at the perimeter. The covers shall be secured to the frames with countersunk, flathead, stainless steel machine screws spaced approximately 6 inches on centers.

2.14 GUARD CHAINS

A. Removable guard chains at openings in aluminum pipe railings shall be fabricated from wrought, non-welded aluminum chain having 12 links per foot. The chains shall be secured to aluminum eyes bolted or welded to pipe stanchion at on end of the opening. The free ends of the chains shall be provided with hooks formed from ¼-inch diameter solid aluminum rod for attaching to similar eyes in the pipe stanchion at the opposite end of the opening.

2.15 CAST IRON WHEEL GUARDS

A. Wheel guards where indicated on the Drawings shall be cast iron guards of the sizes and types indicated on the Drawings as herein specified and shall be manufactured by Neenah Foundry Company, Neenah, WI; Flockhart Foundry Company, Neward, NJ; McKinley Iron Work, Fort Worth, TX or ENGINEER approved equal. Wheel guards shall be given one shop coat of rust inhibitive paint before shipment.

B. Wheel guards shall be heavy-duty concrete fill type, cast iron wheel guards, No., R-4983-C manufactured by Neenah Foundry Company Type 706A manufactured by Flockhart Foundry Company or ENGINEER approved equal. The guards shall be set 2 inches into the pavement and shall be bolted to the masonry walls. The guards shall be filled with Class A concrete and the tope of the fill sloped at a 15 degree angle from the building.

2.16 CAST ALUMINUM NOSINGS

A. The cast aluminum nosing shall be abrasive cast aluminum nosing securely fastened with stainless steel, flat head bolts and wing anchors set into the fresh concrete. The nosings shall be the products of Wooster Products, Inc., Wooster, OH; American Abrasive Metals Company, Irvington, NJ; Andco Building Specialties or ENGINEER approved equal.

2.17 FLOOR HATCHES AND FRAMES

A. The floor hatches and frames shall be flush floor hatches provided by manufacturer as shown in the Drawings or ENGINEER approved equal. Where noted and in areas subject to vehicle traffic, the hatches shall be H-20 rated. The hatches shall be double or single leaf type and of the sizes indicated on the Drawings. The hatches shall be factory assembled and shipped complete with frame for installation on the job. The hatches shall be furnished with hinges, hold open safety lock bars, and flush lift handles. Gutter type hatches shall have a 1½-inch drainage coupling located in on corner of the channel frame.

B. The floor hatches and frames shall be fabricated from aluminum with ¼-inch extruded aluminum frames and $^{1}/_{40}$-inch diamond checkered aluminum plate covers. The covers shall be reinforced to be capable of withstanding a uniform live load of 300 psf (min.).

2.18 ACCESS DOORS

A. Doors shall be flush panel access doors as manufactured Inryco, Inc., Milwaukee, WI; Karp Associates, Inc., Maspeth, NY; BOICO, Birmingham, AL or ENGINEER approved equal. Doors and frames to be steel with concealed hinge and flush screwdriver operated locks.

2.19 CASTINGS

A. All miscellaneous iron castings shall be of best quality materials free from flaws and unsightly defects. Gray cast iron shall be ASTM A 48 Class 35 (35,000 psi tensile strength). Furnish and install in the locations indicated casting of the type and size shown on the Drawings.

1. Expansions anchors shall be installed in holes drilled into concrete with carbide tipped drill bits conforming to ANSI B94.12-1977, using a rotary impact hammer for ½-inch and $^3/_8$-inch anchors. Hole depth shall equal or exceed the anchor manufacturer's minimum recommended embedment. Should hole depth equal anchor manufacturer's minimum recommended embedment, hole shall be cleaned out by air pressure. The minimum hole depth shall be per anchor manufacturer's recommendations. Assure hole is perpendicular and conforms in size to anchor manufacturer's recommendation.
2. Washer and nut shall be assembled on anchor so that the top of the nut is flush with the top of the anchor. Then the anchor shall be driven into the hole through the work until the washer bears against the work. The anchor shall be expanded in accordance with the manufacturer's recommendations.
3. General: Provide stainless steel fasteners for exterior use or where built into exterior walls. Select fasteners for the type, grade and class required.
4. Bolts and Buts: Regular hexagon head type, stainless steel, Grade A (within tankage)
5. Lag Bolts: Stainless steel (within tankage)
6. Machine Screws: Stainless steel
7. Wood Screws: Stainless steel
8. Plain Washers: Stainless steel
9. Masonry Anchorage Devices: Stainless steel
10. Toggle Bolts: Stainless steel (within tankage)
11. Lock Washers: Stainless steel
12. Bolts, buts, lags, toggle bolts and lock washers above and exterior to tankage shall be stainless steel

3.3 WELDING

A. Welding procedures, welders and welding operators, both for shop and field welding, shall be qualified and certified in accordance with the requirements of AWS D1.1 "Welding in Building Construction" of the American Welding Society. Manufacturer's and fabricator's shop drawings shall clearly show complete information and all field welding shall be performed in conformance with this information regarding location, type, size and length of all weld, all in accordance with AWS A2.0 "Standard Welding Symbols" of the American Welding Society. Special conditions shall be fully explained by notes and details.

3.4 HOT-DIP GALVANIZING

A. All fabrication, galvanizing and repair shall comply with ASTM Standards as they apply in accordance with the publication "ASTM Standard for Materials Hot-Dip Galvanized after Fabrication, 1981" issued by American Hot-Dip Galvanizers Association, Inc. In particular, the following specific standards shall apply to work under this contract: ASTM A 123, A 153, A 384, A 385, A 563 and A 780.

B. Items to be galvanized shall be fabricated in accordance with ASTM A 385-80.

C. Galvanizing for fabricated steel items, shall conform to ASTM A 123-78 and shall be done after fabrication. Steel assemblies shall be subject to safeguarding from warpage and distortion during galvanizing per ASTM A 384-76.

D. Upon field erection, any damage measuring more than $^1/_{10}$-inch wide shall be repaired with a zinc-based solder or zinc-rich paint in accordance with ASTM A 780-80. Marred, damaged, or uncoated areas 4-square inches and less shall be patched with a zinc-based solder to a thickness of 5-milligrams; areas greater than 4-square inches shall be patched with an organic zinc-rich paint to a dry film, Devcon Z, LPS Instant Cold Galvanized or ENGINEER approved equal. The resident project representative shall determine the extent of damage, which would require recoating.

E. Items subject to distortion during transit, such as thin, curved members, etc., shall be stacked on edge and/or blocked to prevent radius change or other distortion while in transit to and from the galvanizing plant.

3.5 PAINTING

A. Painting of miscellaneous ferrous metal work is specified under Division 09 - Finishes.

3.6 MISCELLANEOUS METAL FABRICATIONS

A. **Rough Hardware:**

1. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structure. Straight bolts and other stock rough hardware items are specified in Division 05 - Metals.
2. Fabricate items to sizes, shapes and dimensions required. Furnish malleable iron washers for heads and nuts, which bear on wood structural connections; elsewhere, furnish steel washers.

B. **Miscellaneous Steel Trim:**

1. Provide shapes and sizes for profiles shown. Except as otherwise indicated, fabricate units from structural steel shapes and plates and steel bars, with continuously welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cutouts, fittings and anchorages as required for coordination of assembly and installation with other work.
2. Galvanize miscellaneous steel trim where indicated.

- END OF SECTION -

SECTION 07920
CAULKING AND SEALANTS

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. Furnish and install caulking and sealing as indicated in Division 03.

1.2 SUBMITTALS

A. Submittals shall be furnished in accordance with Section 01300 - Submittals.

B. Indicate manufacturers and brand names, colors available and locations where each will be used.

1.3 QUALITY ASSURANCE

A. Comply with requirements of the general conditions except as noted below.

B. Guarantee all work of this section for a period of 2 years.

C. Guarantee all work against water leaks, air infiltration, sagging and pulling loose.

D. Guarantee shall include replacement and/or repair of other work damaged by water leakage in caulking and sealant work.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver sealants in original sealed containers, each bearing manufacturer's name and product designation.

B. Do not retain at the job site material, which has exceeded the shelf life recommended by its manufacturer.

PART 2 – MATERIALS

2.1 SEALANTS

A. **Types 1 to 4 Sealants:** Polyurethane sealants conforming to Federal Specification TT-S-00227E Type II & ANSI A116.1.

1. Type 1 Sealant: Two part 30-40 Shore A, non-sag

   a. Manufacture Sikaflex – 2C or equal

2. Type 2 Sealant: Two part, 35-45 Shore A, self-leveling.
3. Type 3 Sealant: Two part, 20-35 Shore A, self-leveling.
4. Type 4 Sealant: Two part, 20-35 Shore A, non-sag.

B. **Type 5 Sealant:** One component, elastomeric gun grade polyurethane sealant conforming to ASTM C 920, Type S, Grade NS, Class 25. Use NT, M, A, G and I Federal Specifications TT-S-00230C Type 2, Class A.

1. Manufacturer: Sonneborn Sonolastic NP 1 or equal.

2.2 ACCESSORIES

A. **Primers:** As specified by sealant manufacturer

B. **Backup Materials:** Closed cell polyethylene foam

C. **Bond Breaker:** Polyethylene film.

2.3 COLOR

A. Color for each location of use shall be as selected by Owner and in accordance with the contract documents. Non-availability of a required color within a particular brand of otherwise approved material shall not act to relieve obligation to furnish material of required color and conforming to specifications.

B. Colors shall be selected to best blend with adjoining materials.

PART 3 – EXECUTION

3.1 LOCATIONS FOR SEALANT TYPES

A. **Type 1 Sealant:** Use for all interior and exterior construction, expansion joints, etc. associated with sealing the joints in the concrete tanks

B. **Type 2 Sealant:** Except as hereinafter specified, use for all interior and exterior horizontal joints subject to foot traffic.

C. **Type 3 Sealant:** Except as hereinafter specified, or where Type 1 sealant is required, use for all exterior horizontal joint.

D. **Type 4 Sealant:** Use for all exterior vertical surfaces.

E. **Type 5 Sealant:** Use for all interior work except where Type 1 sealant is required.

F. Caulk and seal all open joints, both interior and exterior; at junction of metal frames and walls; at other locations as noted on drawings.

G. Generally, expansion joints in exterior concreted flatwork on grade, curbs and gutter for sitework, etc.; joint fillers will not require a joint sealant. Where sealant is noted on drawings for such joints, sealant shall be Type 1 and a bond breaker shall be installed along top of joint filler, full width of joint, to present contact between sealant and joint filler.

3.2 SEALANT AND JOINT DETAILS

A. **Joint Sizes:**

1. Types 1, 2, 3 and 4 Sealants:

   a. Minimum joint size: ¼-inch x ¼-inch
   b. Depth to width ration of joint shall be a recommended by sealant manufacturer.
   c. Maximum width: Sealant manufacturer's recommended maximum.

2. Type 4 Sealant: Maximum joint size shall be $^{3}/_{8}$-inch x ½-inch.

B. Joints deeper than above shall have backup material installed to maintain specified depth.

C. With Types 1, 2, 3 and 4 sealants, a bond breaker shall be installed, unless backup material is used, so that sealant bonds only sides of joints.

3.3 SEALANT INSTALLATION

A. Carefully and thoroughly clean surfaces with cleaner, and in matter recommended by sealant manufacturer.

B. Prime surfaces where recommended by sealant manufacturer.

C. Apply sealants smoothly and uniformly. Mask surfaces each side of joints to protect adjacent surface and to form straight, even edges.

- END OF SECTION -

SECTION 09800
SPECIAL COATINGS

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. Provide all labor, materials, equipment and services required for accomplishing special coatings on equipment, tanks or piping in accordance with the Contract Documents.

1.2 SPECIAL NOTICE

A. Because there exists in this project corrosive agents in the liquids and, in certain areas, in the atmosphere, special coatings for protecting the select equipment, structures, and appurtenances are required. The service requirements of the coatings are harsh and only products with an extended history of successful application will be acceptable.

B. Related Sections:

1. Division 01 – General Requirements
2. Division 05 – Metals
3. Section 09900 – Painting
4. Division 11 – Equipment

C. Wherever detailed coating/painting requirements are covered under an equipment or product specification, the Specifications herein, shall govern over those coating requirements, with respect to surface preparation, coat materials, coats, thickness and coverage with the exception of manufacturer's supplied coatings and protection. Determine if the manufacturer's supplied coatings are adequate.

1.3 ACCEPTABLE PRODUCTS

A. Unless otherwise noted, the coating products shall be manufactured by the Tnemec Company, the ICI Paints Company, Carboline, the Wisconsin Protective Coatings Corporation, or as approved by Engineer. Coating products must be applied in strict accordance with the manufacturer's recommendations.

1.4 ITEMS REQUIRING SPECIAL COATING

A. See Coating Schedules as listed in PART 2 – PRODUCTS.

1.5 ITEMS NOT REQUIRING SPECIAL COATING

A. The metal surfaces of stainless steel, chromium plate, galvanized and aluminum that are not now coated will not require field coating. Do not apply coating over any code-required labels, glass items, gauges and name plates. It is also important not to coat any moving parts or operating units, valves or stems, or any mechanical and electrical parts such as valve and damper operators, linkages. It is the contactor's responsibility to protect any surface that is not to receive a coating.

1.6 QUALITY ASSURANCE

A. **Qualification of Coaters:** All coating shall be done by qualified, skilled and experienced craftsmen. In the acceptance or rejection of completed coating, no allowance will be made for lack of skills on the part of the craftsmen.

B. **Coating Labels:** Labels on coating containers shall include the following:

1. Manufacturer's name.
2. Generic type of coat.
3. Manufacturer's stock number.
4. Color.
5. Instructions for thinning where applicable.

C. **Field Quality Control:** Coating film thickness shall be subject to measurement with electrometer, wet film gauge, low or high voltage meter and/or applicable measuring instruments acceptable to the ENGINEER. If dry film thickness is found to be less than specified, or coverage is not uniform, an additional coating to correct thickness or appearance at no additional cost shall be applied.

D. **Compatibility:**

1. Compatibility of all coatings used shall be required. A compatible coating will be considered a coat, which precludes adverse effects related to bonding, drying delamination, scaling, lifting and bleeding.
2. In cases where shop-applied primers and coatings on materials and equipment furnished by suppliers are products different from those described in the Specifications, compatibility with the specified field-applied coating system shall be verified by the Contractor.
3. Where thinning is necessary, only the products of the manufacturer furnishing the coating, and products for thinning purposes only, will be allowed.

E. **Thickness and Spreading Rates:**

1. Minimum dry mil thickness per coat (MDMTPC) and/or spreading rates in square feet per gallon shall be governed by the manufacturer's current data sheets or literature containing recommendations or instructions regarding these values. These recommended dry mil thickness and/or spreading rate values will be considered requirements to be met same as if set out herein; these Do Not exceed manufacturer's recommended coverage rates.
2. The number of coats to be applied are specified herein and shall govern. Where the total dry film thickness is specified, this thickness shall govern over the MDMTPC.

1.6 PRODUCT DELIVERY, HANDLING AND STORAGE

A. **Delivery:** All materials shall be brought to the job site in the original sealed and labeled containers of the coating manufacturer. All labels shall be legible and intact at time of use.

B. **Manufacturer's Instruction:** Coating manufacturer's written instructions for proper surface preparation, mixing, thinning, application and drying shall be furnished with the coating and strictly followed.

C. **Storage of Materials:**

1. Store only acceptable materials on project site.
2. Store only in a suitable and designated area restricted to the storage of coating materials and related equipment.
3. Comply with all applicable health and fire regulations regarding the storage of coating materials.
4. Storage of material shall comply with the manufacturer's specifications; however, storage shall be at a minimum temperature of 50 degrees F.

D. **Protection of Materials:**

1. Take all necessary precautions to ensure the safe storage and use of coating materials and the prompt and safe disposal of waste.
2. Coating wastes shall be properly deposited in containers made for this purpose.
3. Take all necessary precautions to protect coating materials before, during and after application and to protect the finished work.

E. **Replacement:** In the event of damage to coating materials, immediately make all replacements necessary to the approval of the ENGINEER and at no additional cost.

F. Product delivery, handling and storage shall be in accordance with Part 1 of this Section and the manufacturer's recommendations.

1.7 JOB CONDITIONS

A. **Environmental Requirements:**

1. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating systems can be applied.
2. Do not apply finish in areas where dust and/or mist is being generated.

B. **Climatic Conditions:** Coating shall not be applied if:

1. The ambient temperature or temperature of the surface to be coated is below 50 degrees F or below the temperature recommended by the coating manufacturer.
2. The relative humidity is above 85 percent.
3. The relative humidity is such that the coating will not dry properly in accordance with the manufacturer's instructions.

C. **Protection:**

1. Protect with drop cloths, masking or other acceptable means all surfaces which could be damaged in function or appearance by coating, including surfaces not being coated concurrently and surfaces not to be coated.
2. Hardware, accessories, fixtures and similar items shall be removed and replaced after completion of coating.
3. Spray coating will not be permitted when it will cause damage to adjacent or otherwise located surfaces.
4. All coating splatters on glass shall be wiped off immediately.

PART 2 – PRODUCTS

2.1 COATING SYSTEMS FOR STEEL - STRUCTURAL, TANKS, ROOF DECKING, PIPE, AND EQUIPMENT

A. **Exterior Exposed:**

1. System Type: Epoxy/Polyurethane.
2. Surface Preparation: SSPC-SP 6.
3. Primer: Series N69 Hi-Build Epoxoline II; 3.0 to 5.0 mils DFT.
4. Intermediate Coat: Series N69 Hi-Build Epoxoline II; 4.0 to 6.0 mils DFT.
5. Finish Coat: Series 1075 Endura-Shield II; 2.5 to 3.5 mils DFT.
6. Total DFT: 9.5 to 14.5 mils.

B. **Interior Exposed:**

1. System Type: Epoxy.
2. Surface Preparation: SSPC-SP 6.
3. Primer: Series N69 Hi-Build Epoxoline II; 3.0 to 5.0 mils DFT.
4. Finish Coat: Series N69 Hi-Build Epoxoline II; 4.0 to 6.0 mils DFT.
5. Total DFT: 7.0 to 11.0 mils.

C. **Immersion:**

1. System Type: Epoxy.
2. Surface Preparation: SSPC-SP 10.
3. Primer: Series N69 Hi-Build Epoxoline II; 3.0 to 5.0 mils DFT.
4. Intermediate Coat: N69 Hi-Build Epoxoline II; 4.0 to 6.0 mils DFT.
5. Finish Coat: Series N69 Hi-Build Epoxoline II; 4.0 to 6.0 mils DFT.
6. Total DFT: 11.0 to 16.0 mils.

D. **Interior/Immersion, Severe Exposure to H2S:**

1. System Type: Modified Epoxy.
2. Surface Preparation: SSPC-SP 5 with minimum 3.0-mil profile.
3. Primer/Finish (One or More Coats): Series 435 Perma-Glaze; 30.0 to 36.0 mils DFT.
4. Total DFT: 30.0 to 36.0 mils.

E. **Marginally Prepared Surfaces (Maintenance, Non-Immersion, Interior):**

1. System Type: Epoxy.
2. Surface Preparation: In accordance with manufacturer's instructions.
3. Primer: Series 135 Chembuild; 4.0 to 6.0 mils DFT.
4. Finish Coat: N69 Hi-Build Epoxoline II; 4.0 to 6.0 mils DFT.
6. Total DFT: 8.0 to 12.0 mils.

F. **Marginally Prepared Surfaces (Maintenance, Non-Immersion, Exterior):**

1. System Type: Epoxy/Polyurethane.
2. Surface Preparation: In accordance with manufacturer's instructions.
3. Primer: Series 135 Chembuild; 4.0 to 6.0 mils DFT.
4. Finish Coat (Exterior): Series 1075 Endura-Shield II; 2.5 to 3.5 mils. DFT
5. Total DFT: 6.5 to 9.5 mils.

2.3 COATING SYSTEMS FOR FACTORY PRIMED STEEL - DOORS, FRAMES, AND MISCELLANEOUS EQUIPMENT

A. **Interior Exposed:**

1. System Type: Epoxy
2. Surface Preparation: Clean and dry.
3. Primer: Factory primed.
4. Field Primer: Series 135 Chembuild; 3.0 to 5.0 mils DFT.
5. Finish Coat: Series 1075 Endura-Shield II; 2.5 to 3.5 mils. DFT

6. Total DFT: 5.5 to 8.5 mils (on top of shop primer).

B. **Exterior Exposed:**

1. System Type: Epoxy/Polyurethane
2. Surface Preparation: Clean and dry.
3. Primer: Factory primed.
4. Field Primer: Series 135 Chembuild; 3.0 to 5.0 mils DFT.
5. Finish Coat: Series 1075 Endura-Shield II; 2.5 to 3.5 mils. DFT
6. Total DFT: 5.5 to 8.5 mils (on top of shop primer).

2.4 COATING SYSTEMS FOR GALVANIZED STEEL AND NONFERROUS METAL - PIPE AND MISCELLANEOUS FABRICATIONS

A. **Interior Exposure:**

1. System Type: Epoxy.
2. Surface Preparation: In accordance with manufacturer's instructions.
3. Primer: Series N69 Hi-Build Epoxoline II; 4.0 to 6.0 mils DFT.
4. Finish Coat: N69 Hi-Build Epoxoline II; 4.0 to 6.0 mils DFT.
6. Total DFT: 8.0 to 12.0 mils.

B. **Exterior Exposure:**

1. System Type: Epoxy/Polyurethane.
2. Surface Preparation: In accordance with manufacturer's instructions.
3. Primer: N69 Hi-Build Epoxoline II; 4.0 to 6.0 mils DFT.
4. Finish Coat: Series 1075 Endura-Shield II; 2.5 to 3.5 mils. DFT
5. Total DFT: 6.5 to 9.5 mils

2.5 COATING SYSTEMS FOR DUCTILE OR CAST IRON - PIPE, PUMPS, AND VALVES

A. **Interior Exposure:**

1. System Type: Epoxy.
2. Surface Preparation: In accordance with manufacturer's instructions.
3. Primer: Series N69 Hi-Build Epoxoline II; 4.0 to 6.0 mils DFT.
4. Finish Coat: N69 Hi-Build Epoxoline II; 4.0 to 6.0 mils DFT.
5. Total DFT: 8.0 to 12.0 mils.

B. **Exterior Exposure:**

1. System Type: Epoxy/Polyurethane.
2. Surface Preparation: In accordance with manufacturer's instructions.
3. Primer: N69 Hi-Build Epoxoline II; 4.0 to 6.0 mils DFT.
4. Finish Coat: Series 1075 Endura-Shield II; 2.5 to 3.5 mils DFT.
5. Total DFT: 6.5 to 9.5 mils

C. **Below Ground:**

1. System Type: Coal tar epoxy.

2. Surface Preparation: In accordance with manufacturer's instructions.
3. Prime/Finish Coat: Series 46H-413 Hi-Build Tneme-Tar; 14.0 to 20.0 mils DFT.
4. Total DFT: 14.0 to 20.0 mils

D. **Immersion:**

1. System Type: Epoxy.
2. Surface Preparation: In accordance with manufacturer's instructions.
3. Primer: Series N69 Hi-Build Epoxoline II; 4.0 to 6.0 mils DFT.
4. Finish Coat: N69 Hi-Build Epoxoline II; 4.0 to 6.0 mils DFT.
5. Total DFT: 8.0 to 12.0 mils

2.6 COATING SYSTEMS FOR PVC

A. **Interior Exposure:**

1. System Type: Epoxy.
2. Surface Preparation: Scarify
3. Primer: Series N69 Hi-Build Epoxoline II; 4.0 to 6.0 mils DFT.
4. Finish Coat: N69 Hi-Build Epoxoline II; 4.0 to 6.0 mils DFT.
5. Total DFT: 8.0 to 12.0 mils.

B. **Exterior Exposure:**

1. System Type: Epoxy/Polyurethane.
2. Surface Preparation: Scarify.
3. Primer: N69 Hi-Build Epoxoline II; 4.0 to 6.0 mils DFT.
4. Finish Coat: Series 1075 Endura-Shield II; 2.5 to 3.5 mils. DFT.
5. Coating provided shall contain UV inhibitor.

2.7 COATING SYSTEMS FOR PRECAST CONCRETE AND CAST-IN-PLACE CONCRETE (REQUIRE WHERE INDICATED IN PLANS)

A. **Exterior Exposed:**

1. System Type: Acrylic.
2. Surface Preparation: SSPC-SP 13/NACE 6. Clean and dry.
3. Primer: Series 180 W.B. Tneme-Crete; 4.0 to 8.0 mils DFT.
4. Finish Coat: Series 180 W.B. Tneme-Crete; 4.0 to 8.0 mils DFT.
5. Total DFT: 8.0 to 16.0 mils.

B. **Below Grade:**

1. System Type: Coal tar.
2. Surface Preparation: SSPC-SP 13/NACE 6. Clean and dry.
3. Primer: 46-465 H.B. Tnemecol. DFT 8.0 to 12.0 mils.
4. Finish Coat: 46-465 H.B. Tnemecol. DFT 8.0 to 12.0 mils.
5. Total DFT: 16.0 to 24.0 mils.

C. **Interior Exposed:**

1. System Type: Epoxy.

2. Surface Preparation: SSPC-SP 13/NACE 6. Abrasive Blast Cleaning.
3. Patching: Series 218 MortarClad (as needed)
4. Primer: Series N69 Hi-Build Epoxoline II; 4.0 to 6.0 mils DFT.
5. Finish Coat: N69 Hi-Build Epoxoline II; 4.0 to 6.0 mils DFT.
6. Total DFT: 8.0 to 12.0 mils.

D. **Severe Service – Immersion, H2S Exposure:**

1. System I (H2S less than 50 ppm, Light Abrasion)
   a. System Type: Modified Epoxy.
   b. Surface Preparation: SSPC-SP 13/NACE 6. Abrasive blast clean to texture of 50 to 60 grit sandpaper.
   c. Surfacing and Patching: Series 218 MortarClad; 1/16 inch DFT (nominal 62.5 mils)
   d. Primer/Finish (One or More Coats): Series 435 Perma-Glaze; 20.0 to 30.0 mils DFT
2. System II (H2S less than 100 ppm, Moderate to Heavy Abrasion)
   a. System Type: Modified Epoxy Mortar.
   b. Surface Preparation: SSPC-SP 13/NACE 6. Abrasive blast clean to texture of 50 to 60 grit sandpaper.
   c. Patching: Series 218 MortarClad; As Needed
   d. Series 434 Perma-Shield H2S; 1/8 inch DFT (nominal 125 mils)
3. System III (H2S more than 100 ppm, Moderate to Heavy Abrasion)
   a. System Type: Modified Epoxy Mortar.
   b. Surface Preparation: SSPC-SP 13/NACE 6. Abrasive blast clean to texture of 50 to 60 grit sandpaper.
   c. Patching: Series 218 MortarClad; As Needed
   d. Series 434 Perma-Shield H2S; 1/8 inch DFT (nominal 125 mils)
   e. Finish (One or More Coats): Series 435 Perma-Glaze; 20.0 to 30.0 mils DFT

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine surfaces scheduled to receive coating for conditions that will adversely affect application, permanence or quality of work and which cannot be put into an acceptable condition through surface preparation.

B. Do not proceed with surface preparation or coating application until conditions are suitable.

3.2 ACCEPTANCE OF SURFACES

A. The commencement of coating work in any area or space will be construed as acceptance of the surface as being satisfactory.

3.3 PREPARATION AND APPLICATION

A. Preparation and application shall be in accordance with coating systems (Article 2.1).

3.4 FINAL INSPECTION

A. Protect all coated surfaces against damage until the date of final acceptance.

B. Conduct a final inspection of all coating work and recoat or retouch any areas or surfaces found deficient in complying with these Specifications.

3.5 PIPING IDENTIFICATION

A. All visible piping ¾-inch and greater which is accessible for maintenance and operations shall be color-coded and identified with appropriate identification markers. Direction of flow arrows are to be included with each identification mark unless otherwise specified.

B. Each marker shall be black lettering on a yellow or white background and have a clearly printed legend to identify the contents of the pipe.

C. Locations for pipe markers to be as follows:

1. Adjacent to each valve (except as plumbing fixtures and equipment).
2. At each branch and riser take-off.
3. At each pipe passage through wall, floor and ceiling construction.
4. At each pipe passage to underground
5. On all horizontal pipe runs, marked every 30 feet.

3.6 PIPE COLOR CODE

Process or Fluid Description	Color	Tnemec Color #
Potable Water	Dark Blue	11SF
Raw Sewage	Dark Gray	33GR
Influent		
Equalization Basin		
Secondary	Light Grey	31GR
RAS		
Clarifier RAS		
Tertiary/Reclaimed	Purple (Pantone)	14SF
Sludge	Dark Brown	84BR
WAS		
Backwash Waste	Light Brown	68BR
Compressed Air	Dark Green	91GN
Fire Protection	Red	06SF
Foul Air	White	11WH
Chlorine (Gas or Solution)	Yellow	02SF
Polymer or Coagulant Aid	Orange	04SF

- END OF SECTION -

SECTION 09900
PAINTING

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. Provide all labor, materials, equipment and services required to do all painting (excluding items listed in Section 09800 - Special Coatings), including preparation, priming and protection of finished surfaces. An extensive and comprehensive painting job will be required and shall include all surfaces which normally are painted.

B. The intent of these Specifications is to obtain the material and workmanship necessary to produce an adequate and acceptable job, and is intended to describe the requirements for both shop and field painting.

C. The intent of this Specification Section is to include all items which are to receive painting and have not been included in Section 09800 – Special Coatings.

D. The intent of this Specification Section and Section 09800 – Special Coatings shall be to paint all exposed structural steel, miscellaneous ferrous metal, lintels, equipment, piping, all exterior masonry walls and all other work obviously required or noted to be painted unless otherwise specified (see Section 2.1). The omission of minor items in the schedule of work shall not relieve the obligation to include such items where they come within the general intent of the Specifications as stated herein. All interior surfaces and equipment which have been previously painted shall be repainted or recoated following the proper surface preparation as shown on the Drawings.

E. Review and examine all Divisions and Sections of these Specifications for any additional painting requirements and/or additional surfaces or items to be painted.

F. Apply specified finish coats of paint to all pre-primed work and complete finishing system for unprimed work required to be painted.

G. Backprime, with specified interior first coat material all surfaces of finish trim which will be concealed after installation.

H. Apply specified finish coats of paint to all prepainted surfaces which require only a finish coat. Otherwise, the complete system (as given in Section 2.1) shall be administered.

1.2 RELATED WORK

A. **Related Sections:**

1. Division 01 – General Requirements
2. Division 05 – Metals
3. Section 07920 – Caulking and Sealants
4. Section 09800 – Special Coatings

B. Wherever detailed painting requirements are covered under an equipment or product specification, the Specifications herein and Section 09800 – Special Coatings govern with respect to surface preparation, paint materials, coats, thicknesses and coverage.

1.3 ITEMS NOT REQUIRING FIELD PAINTING

A. All new galvanized and stainless steel surfaces (except where noted on Drawings).

B. Valves, fittings and appurtenances in small diameter plastic piping (less than 3 inches).

C. Prefinished items.

D. Plain copper (except as required for color coding) and stainless steel.

E. Aluminum except where otherwise designated and required to prevent corrosion at contact with dissimilar materials.

F. Concrete floors except where noted.

G. Exterior concrete surfaces except where noted.

H. Finish hardware.

I. Concealed from view items (except where required for color coding) and surfaces, except as specified herein or where previously painted.

J. Packing glands and other adjustable parts and nameplates of mechanical equipment.

K. Mechanical equipment (i.e. pumps, blowers, actuators, etc.)

1.4 DEFINITIONS

A. The term "paint" as used herein includes enamels, epoxy, paints, sealers, fillers, emulsions and other coatings.

B. MDMTPC = Minimum dry mil thickness per coat.

C. MDFT = Minimum dry film thickness.

D. SSPC = Steel Structures Painting Council.

1.5 QUALITY ASSURANCE

A. **Qualification of Painters:** All painting shall be done by qualified, skilled, experienced craftsmen. In the acceptance or rejection of completed painting, no allowance will be made for lack of skills on the part of the craftsmen.

B. **Paint Labels:** Labels on paint containers shall include the following:

1. Manufacturer's name
2. Generic type of paint
3. Manufacturer's stock number
4. Color
5. Instructions for thinning where applicable

C. **Field Quality Control:** Paint film thickness shall be subject to measurement by electrometer, wet film gauge, low or high voltage meter, and/or ENGINEER approved measuring instruments. If dry film thickness is found to be less than specified, or coverage is not uniform, apply additional paint to correct the thickness or appearance at no additional cost to the Owner.

D. **Compatibility:**

1. Compatibility of all paints used is required. A compatible paint will be considered a paint which precludes adverse effects related to bonding, drying delamination, scaling, lifting and bleeding.
2. In cases where shop-applied primers and coatings on materials and equipment furnished by suppliers are products different from those described in the Specifications, compatibility shall be verified with the specified field-applied coating system.
3. Where thinning is necessary, only the products of the manufacturer furnishing the paint, and products for thinning purposes only, will be allowed.

E. **Thickness and Spreading Rates:**

1. Minimum dry mil thicknesses per coat (MDMTPC) and/or spreading rates in square feet per gallon shall be governed by the manufacturer's current data sheets or literature containing recommendations or instructions regarding these values. These recommended dry mil thickness and/or spreading rate values will be considered requirements to be met same as if set out herein these Specifications and Contract Documents. Do not exceed manufacturer's recommended coverage rates.
2. The number of coats to be applied are specified herein and shall govern. Where the total dry film thickness is specified, this thickness shall govern over the MDMTPC.

1.6 PRODUCT DELIVERY, HANDLING AND STORAGE

A. **Delivery:** All materials shall be brought to the project site in the original sealed and labeled containers of the paint manufacturer. All labels shall be legible and intact at time of use.

B. **Manufacturer's Instructions:** Paint manufacturer's written instructions for proper surface preparation, mixing, thinning, application and drying shall be furnished with the paint, and strictly followed.

C. **Storage of Materials:**

1. Store only acceptable materials on project site.
2. Store only in a suitable and designated area restricted to the storage of paint materials and related equipment.
3. Comply with all applicable health and fire regulations regarding the storage of paint materials.
4. Storage of material shall comply with the manufacturer's specifications; however, storage shall be at a minimum temperature of 50 degrees F.

D. **Protection of Materials:**

1. Take all necessary precautions to ensure the safe storage and use of paint materials and the prompt and safe disposal of waste.
2. Painting wastes shall be properly deposited in containers made for this purpose. Do not use plumbing fixtures for disposing of paints wastes.
3. Take all necessary precautions to protect paint materials before, during and after application and to protect the finished work.

E. **Replacement:** In the event of damage to paint materials, immediately make all replacements necessary at no additional cost.

F. Product delivery, handling and storage shall be in accordance with Part 1 of this Specification.

1.7 JOB CONDITIONS

A. **Environmental Requirements:**

1. Comply with manufacturer's recommendations as to the environmental conditions under which painting systems can be applied.
2. Do not apply finish in areas where dust and/or mist is being generated.

B. **Climatic Conditions:** Paint shall not be applied if:

1. The ambient temperature or temperature of the surface to be painted is below 50 degrees F or below the temperature recommended by the paint manufacturer.
2. The relative humidity is above 85 percent.
3. The relative humidity is such that the paint will not dry properly in accordance with the manufacturer's instructions.

C. **Projection:**

1. Protect with drop cloths, masking or other acceptable means all surfaces which could be damaged in function or appearance by paint, including surfaces not being painted concurrently and surfaces not to be painted.
2. Hardware, accessories, fixtures and similar items shall be removed and replaced after completion of painting.
3. Spray painting will not be permitted when it will cause damage to adjacent of otherwise located surfaces.
4. All paint splatters on glass shall be wiped off immediately.

PART 2 – PRODUCTS

2.1 PAINT SYSTEMS

A. **General:**

1. All paints of a system shall be by one (1) manufacturer.
2. "Lift" tests may be requested on various surfaces to be painted to assure bonding compatibility.
3. Paints containing lead, or other "dangerous" materials, that surpass federal maximum levels shall not be allowed. Oil shall be pure boiled linseed oil.

2.2 COLORS

A. The manufacturer shall be able to furnish all paints for exposed surfaces in a wide range of colors including lighter and darker shades of these colors which may be selected on various surfaces, if not included in the following codes (also note, the below listed may be included in the requirements of Section 09800 – Special Coatings):

1. Safety Color Codes: Comply with Occupational Safety and Health Administration Standards, as applicable, regarding safety color codes.
2. Piping Color Codes: Colors for process pipe coding shall be as specified in Section 09800 – Special Coatings.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine surfaces scheduled to receive paint and/or coating finishes for conditions that will adversely affect application, permanence or quality of work and which cannot be put into an acceptable condition through surface preparation.

B. Do not proceed with surface preparation or painting application until conditions are suitable.

C. If surfaces are not thoroughly dry or if they cannot be put in proper conditions to receive paint by customary cleaning methods, the painting applicators shall notify the ENGINEER in writing, requesting necessary corrections.

D. Review the specified or approved painting systems and bring any questions or doubts as to the proper performance to the ENGINEER. Otherwise, assume the responsibility for providing the desired results.

3.2 ACCEPTANCE OF SURFACES

A. The commencement of painting work in any area or space will be construed as acceptance of the surface as being satisfactory.

3.3 SURFACE PREPARATION

A. **General:**

1. All surfaces shall be thoroughly cleaned and free of dust, rust, mill scale, loose paint or oily materials.
2. References to SSPC refer to Steel Structures Painting Council specifications.
3. Surfaces shall be primed and/or treated, as specified, as soon after completion of surface preparation as practical, but in any event before any visible or detrimental corrosion or contamination can occur. A prepared surface, which becomes corroded or contaminated, shall be re-prepared before treating and/or priming.

B. **Non-submerged Non-Galvanized Structural Steel:** All new non-galvanized structural steel for non-submerged service shall have their surfaces prepared according to SSPC-SP6-63, Commercial Blast Cleaning.

C. **Submerged Non-Galvanized Structural Steel:** All new non-galvanized structural steel and fabricated metals for submerged service of high temperature service shall have their surfaces prepared according to SSPC-SP10-63T Near White Metal Blast Cleaning.

D. **Unprimed Metal Surfaces:** All unprimed metal surfaces and miscellaneous fabricated metals (exclusive of structural steel and galvanized metal) to be painted shall be thoroughly cleaned according to SSPC-SP2-63 Hand Tool Cleaning or SSPC-SP3-63 Power Tool Cleaning, unless specifically required elsewhere in these Specifications.

E. **Non-Ferrous Metals:** Non-ferrous metals surface preparation shall be not less than that required by the paint manufacturer.

F. Concrete and Masonry:

1. All concrete and masonry surfaces shall be cleaned and free from loose particles.

2. Concrete floors to be painted shall be etched with a 10 percent solution of muriatic acid. If the concrete surface is exceedingly dense, a greater strength acid or a second etching will be required. After etching for a minimum of 30 minutes, wash thoroughly with water to remove all traces of acid. Allow to thoroughly dry at least 72 hours.
3. Submerged concrete to be coated shall have their surfaces prepared by a light sandblast (Brush Blast), to remove loose coating and provide a textured surface to enhance adherence of the new coating. No sandblasting shall be done on the job in areas containing pumps, motors or other equipment that could be damaged by infiltration of sand particles.

G. **Wood Surfaces:** Wood surfaces shall be thoroughly cleaned of all extraneous matter and all cracks, nail holes, and other defects properly filled and smoothes. Wood trim shall be sanded to fine finish and wiped clean of dust.

3.4 SHOP PRIMING

A. The requirements Specification Section 09800 will govern over this Specification Section requirements.

B. Shop priming shall be done with primers that are guaranteed by the equipment manufacturer to be compatible with the finish paints to be used.

C. The CONTRACTOR shall coordinate all paint materials supplied in the shop and field.

3.5 APPLICATION

A. On metal surfaces apply each coat of paint at the rate specified by the manufacturer to achieve the minimum dry mill thickness required. One gallon of paint as originally furnished by the manufacturer shall not cover a greater area when applied by spray gun than when applied unthinned by brush. Deficiencies of film thickness shall be corrected.

B. On masonry, the application rates will vary according to surface texture; however, in no case shall the manufacturer's stated coverage rate be exceeded.

C. On porous surfaces, it shall be the painter's responsibility to achieve a protective and decorative finish either by decreasing the coverage rate of by applying additional coats of paint.

D. Evenly brush out each finish coat and permit to dry per manufacturer's recommendation before applying any subsequent coats.

E. All paints and catalogs shall be maintained at a minimum manufacturer's application temperature before applying.

F Successive coats of paint shall be tinted so as to make each coat easily distinguishable from each other with the final undercoat tinted to a darker shade than the finish coat.

G. Finish surfaces shall not show brush marks or other irregularities. Undercoats shall be thoroughly and uniformly sanded with No. 00 sandpaper or equal to remove defects and provide a smooth even surface.

H. Painting shall be continuous and shall be accomplished in an orderly manner so as to facilitate inspection. Materials subject to weathering shall be prime coated as quickly as possible. Surfaces of exposed members that will be inaccessible after erection shall be cleaned and painted before erection.

I. All surfaces to be painted as well as the atmosphere in which painting is to be done shall be maintained at the conditions recommended by manufacturer by heating and ventilating, if necessary, until each coat of paint has hardened. Any defective paint shall be removed and the surface repainted.

J. Perform all required back priming work before items are installed.

3.6 REINSTALLATION OF REMOVED ITEMS

A. Following completion of painting in each space, promptly reinstall all items removed for painting, using only workmen skilled in the particular trade.

3.7 CLEANING

A. During the progress of Work, do not allow the accumulation of empty containers or other excess items except in areas specifically reserved for that purpose.

B. Take all precautions to prevent accidental spillage of paint materials. In the event of spilling, immediately remove all spilled materials and the waste and other equipment used to clean up the spill, and wash surfaces to their original undamaged condition.

C. Touch-up and restore finish where damaged.

D. Remove all trash and accumulated materials of a painting nature from premises at the completion of the Work.

E. Paint spots, oil or stains upon adjacent surfaces shall be removed. Any damage to Work of other trades or equipment caused from painting shall be made good at no additional expense.

F. Do not mark surface finish of items being cleaned.

G. Leave entire job clean (including paint storage space).

3.8 FINAL INSPECTION

A. Protect all painted surfaces against damage until the date of final acceptance of the Work.

B. Conduct a final inspection of all painting work and repaint or retouch any areas or surfaces found deficient in complying with these Specifications.

- END OF SECTION -

SECTION 11000
EQUIPMENT GENERAL PROVISIONS

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. All equipment and appurtenant work, complete and operable, in accordance with the Contract Documents shall be provided.

B. The provisions of this Section shall apply to all equipment except where otherwise indicated.

C. **Equipment Arrangement:** Unless specifically indicated otherwise, the arrangement of equipment shown on the Drawings is based upon information available at the time of design and is not intended to show exact dimensions particular to a specific manufacturer in all cases. Some aspects of the Drawings are diagrammatic and some features of the illustrated equipment arrangement may require revision to meet the actual equipment requirements. Structural supports, foundations, piping and valve connections, and electrical and instrumentation connections indicated may have to be altered to accommodate the equipment provided.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Equipment shall be in accordance with the following standards, as applicable and as indicated in each equipment specification:**

1. American Society for Testing and Materials (ASTM).
2. American National Standards Institute (ANSI)
3. American Society of Mechanical Engineers (ASME).
4. American Water Works Association (AWWA).
5. American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE).
6. American Welding Society (AWS).
7. National Fire Protection Association (NFPA).
8. Federal Specifications (FS).
9. National Electrical Manufacturers Association (NEMA).
10. Manufacturer's published recommendations and specifications.
11. Occupational Safety and Health Administration (OSHA).

B. **The following standards are referenced in this Section:**

ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800
ANSI B16.5	Pipe Flanges and Flanged Fittings, Steel, Nickel Alloy and other Special Alloys
ANSI B46.1	Surface Texture
ANSI S12.6	Method for the Measurement of the Real-Ear Attenuation of Hearing Protectors
ASME B1.20.1	General Purpose Pipe Threads (Inch)
ASME B31.1	Power Piping
AWWA C206	Field Welding of Steel Water Pipe

AWWA C207	Steel Pipe Flanges for Waterworks Service - Sizes 4 in. through 144 in. (100 mm through 3,600 mm)
ASTM A 48	Gray Iron Castings
ASTM A 108	Steel Bars, Carbon, Cold-Finished, Standard Quality

1.3 SUBMITTALS

A. Submittals shall be made in accordance with Section 01300 - Submittals.

B. **Shop Drawings:** Furnish complete drawings and technical information for equipment, piping, valves and controls. Where indicated or required by the ENGINEER, Shop Drawings shall include clear, concise calculations showing equipment anchorage forces and the capacities of the anchorage elements.

C. **Spare Parts List:** A list of spare parts for each piece of equipment shall be obtained from the manufacturer and submitted at the same time as Shop Drawings. The name, address and telephone number of the nearest distributor for each piece of equipment shall be furnished. This list shall contain all data necessary to allow the OWNER to purchase spare parts as necessary.

1.4 QUALITY ASSURANCE

A. **Inspection:** The local authorities shall be informed to witness all required tests for piping, plumbing, fire protection systems, pressure vessels, safety systems, and related items.

B. **Quality and Tolerances:** Tolerances and clearances shall be as shown on the Shop Drawings and shall be closely adhered to.

1. Machine work shall in all cases be of high-grade workmanship and finish, with due consideration to the special nature or function of the parts. Members without milled ends and which are to be framed to other steel parts of the structure may have a variation in the detailed length of not greater than 1/16-inch for members 30-feet or less in length, and not greater than 1/8-inch for members over 30-feet in length.
2. Castings shall be homogeneous and free from non-metallic inclusions and defects. Surfaces of castings which are not machined shall be cleaned to remove foundry irregularities. Casting defects not exceeding 12.5 percent of the total thickness and where defects will not affect the strength and serviceability of the casting may be repaired by approved welding procedures. If the removal of metal for repair reduces the stress-resisting cross-section of the casting by more than 25 percent or to such an extent that the computed stress in the remaining metal exceeds the allowable stress by more than 25 percent, then the casting may be rejected.
3. All materials shall meet the physical and mechanical properties in accordance with the reference standards.

C. **Machine Finish:** The type of finish shall be the most suitable for the application and shall be shown in micro-inches in accordance with ANSI B46.1. The following finishes shall be used:

1. Surface roughness not greater than 63 micro-inches shall be required for all surfaces in sliding contact.
2. Surface roughness not greater than 250 micro-inches shall be required for surfaces in contact where a tight joint is not required.
3. Rough finish not greater than 500 micro-inches shall be required for other machined surfaces.
4. Contact surfaces of shafts and stems which pass through stuffing boxes and contact surfaces of bearings shall be finished to not greater than 32 micro-inches.

1.5 SPARE PARTS AND TOOLS

A. Spare parts shall be furnished as indicated in the individual equipment sections. All spare parts shall be suitably packaged in the original manufacturer's box and labeled clearly with equipment numbers and name tags attached to the box.

B. Special tools shall be suitably packaged and clearly labeled and directions shall be provided for intended use.

PART 2 – PRODUCTS

2.1 GENERAL REQUIREMENTS

A. **Noise Level:** When in operation, no single piece of equipment shall exceed the OSHA noise level requirement of 105 dBA for one-hour exposure per day without sound enclosure or sound dampening devices.

B. **High Noise Level Location:** One personal hearing protection station at each high noise level location shall be provided. Locations are defined as follows:

1. Outdoor Location: Any single equipment item or any group of equipment items that produce noise exceeding OSHA noise level requirements for a 2-hour exposure. Where such equipment is separated by a distance of more than 20 feet, measured between edges of footings, each group of equipment shall be provided with a separate hearing protection station.
2. Indoor Location

    a. Any single equipment item or any group of equipment items located within a single room not normally occupied, that produces noise exceeding OSHA noise level requirements for a 2-hour exposure.
    b. Any single equipment item or any group of equipment items located within a single room normally occupied by workers, that produces noise exceeding OSHA noise level requirements for an 8-hour exposure.

C. **Personal Hearing Protection:** Three pairs of high attenuation hearing protectors in the original unopened packaging shall be provided. The ear protectors shall be capable of meeting the requirements of ANSI S12.6 and shall produce a noise level reduction of 25 dBA at a frequency of 500 Hz. The hearing protectors shall have ear cushions and a variable, padded headband.

D. **Drive Trains and Service Factors:** Service factors shall be applied in the selection or design of mechanical power transmission components. All components of drive train assemblies between the prime mover and the driven equipment shall be designed and rated to deliver the maximum peak or starting torque, speed, and horsepower. All of the applicable service factors shall be considered, such as mechanical (type of prime mover), load class, start frequency, ventilation, ambient temperature and fan factors. Drive train components include couplings, shafts, gears and gear drives, drive chains, sprockets and V-belt drives. Unless otherwise indicated, the following load classifications shall apply in determining service factors:

Type of Equipment	Service Factor	Load Classification
Reciprocating Air Compressors:		
Multi-Cylinder	2.0	Heavy Shock
Single-Cylinder	2.0	Heavy Shock
Pumps:		
Centrifugal or Rotary	1.0	Uniform
Reciprocating	1.8	Moderate Shock
Cranes or Hoists	1.25	Moderate Shock

E. **Mechanical Service Factors:**

	Electric Motor	Internal Combustion Engine
Uniform	1.25	1.50
Moderate Shock	1.50	1.75
Heavy Shock	2.00	2.25

F. For thermal rating adjustments such as start frequency, ambient temperature, and hourly duty cycle factor, ventilation factor, and fan factor, refer to gear manufacturer sizing information.

G. For service factors of electric motors, see Section 11100 – Pumps, General.

H. Where load classifications are not indicated, service factors based on AGMA 514.02 shall be used for standard load classifications and service factors for flexible couplings,

I. **Welding:** Unless otherwise indicated, welding shall conform to the following:

1. Latest revision of AWWA D100.
2. Latest revision of AWWA C206.
3. Composite fabricated steel assemblies that are to be erected or installed inside a hydraulic structure, including any fixed or movable structural components of mechanical equipment, shall have continuous seal welds to prevent entrance of air or moisture.
4. Welding shall be by the metal-arc method or gas-shielded arc method as described in the American Welding Society's "Welding Handbook" as supplemented by other pertinent standards of the AWS. Qualification of welders shall be in accordance with the AWS Standards.
5. In assembly and during welding, the component parts shall be adequately clamped, supported, and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall be as specified by the AWS code. Upon completion of welding, weld splatter, flux, slag and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance, with uniform weld contours and dimensions. Sharp corners of material that is to be painted or coated shall be ground to a minimum of 1/32-inch on the flat.

J. **Protective Coating:** Equipment shall be painted or coated in accordance with Section 09800 - Special Coatings and Section 09900 - Painting, unless otherwise indicated.

K. **Identification of Equipment Items:** Each item of equipment shipped shall have a legible identifying mark corresponding to the equipment number for the particular item.

L. **Vibration Isolators:** Air compressors, blowers, engines, inline fans shall be provided with restrained spring-type vibration isolators or pads per manufacturer's written recommendations.

M. **Shop Fabrication:** Shop fabrication shall be performed in accordance with the Contract Documents and the Shop Drawings.

N. **Controls:** Equipment and system controls shall be in accordance with Division 17 - Instrumentation.

2.2 EQUIPMENT SUPPORTS AND FOUNDATIONS

A. **Equipment Supports:** Unless otherwise indicated, equipment supports, anchors, and restrainers shall be adequately designed for static, dynamic, wind, and seismic loads. The design horizontal seismic force shall be the greater of: that noted in the general structural notes or as required by the governing building code, or 10 percent of gravity. Submitted design calculations for equipment supports shall bear the signature and seal of an engineer registered in the State wherein the project is to be built, unless otherwise indicated.

B. **Equipment Foundations:** Mechanical equipment, tanks, control cabinets, enclosures, and related equipment shall be mounted on minimum 3.5-inch high concrete bases, where indicated. Equipment foundations are indicated on Drawings. The size and weight of equipment foundation to insure compatibility with equipment shall be verified through the equipment manufacturer.

2.3 COUPLINGS

A. Mechanical couplings shall be provided between the driver and the driven equipment. Flexible couplings shall be provided between the driver and the driven equipment to accommodate slight angular misalignment, parallel misalignment, end float, and to cushion shock loads. Unless otherwise indicated or recommended by the equipment manufacturer, coupling type shall be furnished with the respective equipment as follows:

Equipment Type	Coupling Type
Air Compressors / Air Blowers	Belt, gear or flexible disc pack

B. Each coupling size shall be determined based on the rated horsepower of the motor, speed of the shaft, and the load classification service factor. The equipment manufacturer shall select or recommend the size and type of coupling required to suit each specific application.

C. **Differential Settlement:** Where differential settlement between the driver and the driven equipment may occur, 2 sets of universal type couplings shall be provided.

D. **Taper-Lock** or equal bushings may be used to provide for easy installation and removal of shafts of various diameters.

2.4 SHAFTING

A. **General:** Shafting shall be continuous between bearings and shall be sized to transmit the power required. Keyways shall be accurately cut in line. Shafting shall not be turned down at the ends to accommodate bearings or sprockets whose bore is less than the diameter of the shaft. Shafts shall rotate in the end bearings and shall be turned and polished, straight, and true.

B. **Design Criteria**: All shafts shall be designed to carry the steady state and transient loads suitable for unlimited number of load applications, in accordance with ASME B106.1M, - Design of Transmission Shafting. Where shafts are subjected to fatigue stresses, such as frequent start and stop cycles, the mean stress

shall be determined by using the modified Goodman Diagram. The maximum torsional stress shall not exceed the endurance limit of the shaft after application of the factor of safety of 2 in the endurance limit and the stress concentration factor of the fillets in the shaft and keyway. Stress concentration factor shall be in accordance with ASME Standard B17.1 - Keys and Keyseats.

C. **Materials:** Shafting materials shall be appropriate for the type of service and torque transmitted. Environmental elements such as corrosive gases, moisture and fluids shall be taken into consideration. Materials shall be as indicated unless furnished as part of an equipment assembly.

1. Low carbon cold-rolled steel shafting shall conform to ASTM A 108, Grade 1018.
2. Medium carbon cold-rolled shafting shall conform to ASTM A 108, Grade 1045.
3. Other grades of carbon steel alloys shall be suitable for service and load.
4. Corrosion-resistant shafting shall be stainless steel or Monel, whichever is most suitable for the intended service.

D. **Differential Settlement:** Where differential settlement between the driver and the driven equipment may occur, a shaft of sufficient length with 2 sets of universal type couplings shall be provided.

2.5 V-BELT DRIVES

A. V-belts and sheaves shall be of the best commercial grade and shall conform to ANSI, MPTA, and RMA Standards.

B. Unless otherwise indicated, sheaves shall be machined from the finest quality gray cast iron.

C. Sheaves shall be statically balanced. In some applications where vibration is a problem, sheaves shall be dynamically balanced. Sheaves operating at belt speeds exceeding 6,500 rpm may be required to be of special materials and construction.

D. Finish bored sheaves shall be complete with keyseat and setscrews.

E. Sliding motor bases or auto-tension, spring suspension shall be provided to adjust the tension of V-belts.

2.6 DRIVE GUARDS

A. Power transmission trains, prime movers, machines, shaft extensions, and moving machine parts shall be guarded to conform with the Division of Industrial Safety General Industrial Safety Orders latest edition. The guards shall be constructed of minimum 10 gage expanded, flattened steel with smooth edges and corners, galvanized after fabrication, and securely fastened. Where required for lubrication or maintenance, guards shall have hinged and latched access doors.

2.7 BEARINGS

A. **General:** Bearings shall conform to the standards of the Anti-Friction Bearing Manufacturers Association, Inc. (AFBMA).

B. To assure satisfactory bearing application, fitting practice, mounting, lubrication, sealing, static rating, housing strength, and lubrication shall be considered in bearing selection.

C. Re-lubricatable type bearings shall be equipped with a hydraulic grease fitting in an accessible location and shall have sufficient grease capacity in the bearing chamber.

D. Lubricated-for-life bearings shall be factory-lubricated with the manufacturer's recommended grease to insure maximum bearing life and best performance.

E. **Anti-Friction Type Bearing Life:** Except where otherwise indicated, bearings shall have a minimum L-10 life expectancy of 5 years or 20,000 hours, whichever occurs first. Where so indicated, bearings shall have a minimum rated L-10 life expectancy corresponding to the type of service, as follows:

Type of Service	Design Life (years)	L-10 Design Life (hours)
	(whichever comes first)	
8-hour shift	10	20,000
16-hour shift	10	40,000
Continuous	10	60,000

F. Bearing housings shall be of cast iron or steel and bearing mounting arrangement shall be as indicated or as recommended in the published standards of the manufacturer. Split-type housings may be used to facilitate installation, inspection, and disassembly.

G. **Sleeve Type Bearings**: Sleeve-type bearings shall have a cast iron or ductile iron housing and Babbitt or bronze liner. Bearing housing shall be bolted and doweled to the lower casing half. These housings shall be provided with cast iron caps bolted in place and the bearing end caps shall be bored to receive the bearing shells. Sleeve bearings shall be designed on the basis of the maximum allowable load permitted by the bearing manufacturer. If the sleeve bearing is connected to an equipment shaft with a coupling, the coupling transmitted thrust will be assumed to be the maximum motor or equipment thrust. Lubricant, lubrication system, and cooling system shall be as recommended by the bearing manufacturer.

H. **Plate Thrust Bearings**: Thrust bearings shall be the Kingsbury Type, designed and manufactured to maintain the shaft in the fixed axial position without undue heating or the necessity of adjustment or attention. Bearings shall be oil lubricated to suit the manufacturer's standard method of lubrication for the specific bearing. If bearing cooling is required, manufacturer shall provide necessary piping, filters, and valves.

2.8 PIPING CONNECTIONS

A. **Pipe Hangers, Supports, and Guides:** Pipe connections to equipment shall be supported, anchored, and guided to avoid stresses and loads on equipment flanges and equipment. Supports and hangers shall be in accordance with Section 15006 - Pipe Supports.

B. **Flanges and Pipe Threads:** Flanges on equipment and appurtenances shall conform to ANSI B16.1, Class 125, or B16.5, Class 150, unless otherwise indicated. Pipe threads shall be in accordance with ANSI/ASME B1.20.1 and Section 15000 - Piping, General.

C. **Flexible Connectors:** Flexible connectors shall be installed in all piping connections to engines, blowers, compressors, and other vibrating equipment and in piping systems in accordance with the requirements of Section 15000 – Piping, General. Flexible connectors shall be harnessed or otherwise anchored to prevent separation of the pipe where required by the installation.

D. **Insulating Connections:** Insulating bushings, unions, couplings, or flanges, as appropriate, shall be used in accordance with the requirements of the Section 15000.

2.9 GASKETS AND PACKINGS

A. Gaskets shall be in accordance with Section 15000 – Piping, General.

B. Packing around valve stems and reciprocating shafts shall be of compressible material, compatible with the fluid being used. Chevron-type "V" packing shall be **Garlock No. 432, John Crane "Everseal,"** or equal.

C. Packing around rotating shafts (other than valve stems) shall be "O"-rings, stuffing boxes, or mechanical seals, as recommended by the manufacturer, in accordance with Section 11100 - Pumps, General.

2.10 NAMEPLATES

A. Equipment nameplates of stainless steel shall be engraved or stamped and fastened to the equipment in an accessible location with No. 4 or larger oval head stainless steel screws or drive pins. Nameplates shall contain the manufacturer's name, model, serial number, size, characteristics, and appropriate data describing the machine performance ratings.

2.11 EQUIPMENT LUBRICANTS

A. Lubricants for all equipment during storage and prior to initial testing of the equipment shall be installed.

PART 3 – EXECUTION

3.1 SERVICES OF MANUFACTURER

A. **Inspection, Startup, and Field Adjustment**: Where required by individual sections, an authorized, experienced, and competent service representative of the manufacturer shall visit the Site to witness or perform the following in accordance with Section 01450 – Services of Manufacturer's Representative and to certify in writing that the equipment and controls have been properly installed, aligned, lubricated, adjusted, and readied for operation.

1. Inspection, checking, and adjusting the equipment and approving its installation.
2. Startup and field testing for proper operation, efficiency, and capacity.
3. Performing field adjustments during the test period to ensure that the equipment installation and operation comply with requirements.
4. Instruct plant operating personnel on proper operations, maintenance and care.

3.2 INSTALLATION

A. **General:** Equipment shall be installed in accordance with the manufacturer's written recommendations.

B. **Alignment**: Equipment shall be field tested to verify proper alignment.

3.3 PRE-PACKAGED EQUIPMENT

A. Coordination of all necessary space and structural requirements, clearances, utility connections, signals, and outputs shall be required to avoid later change orders, when any system is furnished as pre-packaged equipment.

3.4 WELDING

A. Welds shall be cleaned of weld-slag, splatter, etc. to provide a smooth surface. Metal brushes shall be the same material as the metal welded. Stainless steel brushes shall be used for cleaning stainless steel welds.

3.5 FIELD TESTS

A. Where indicated by the individual equipment sections, equipment shall be field tested after installation to demonstrate satisfactory operation without excessive noise, vibration, or overheating of bearings or motor.

B. The following field testing shall be conducted:

1. Start equipment, check, and operate the equipment over its entire operating range. Vibration level shall be within the amplitude limits as indicated or as recommended by the reference applicable Standards.
2. Obtain concurrent readings of motor voltage, amperage, capacity, vibration and bearing temperatures.

C. In the event that any equipment fails to meet the test requirements, the equipment shall be modified and retested until it satisfies the requirement.

- END OF SECTION -

SECTION 11140
SOLAR ENERGY ELECTRICAL POWER GENERATION EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:

1. Furnish and install grid tied photovoltaic system as described in Contract Documents.

B. Related Sections:

1. Section 16000: General Electrical Requirements

1.2 QUALITY ASSURANCE

A. Contractor expressly warrants that all goods or services furnished under this standard shall conform to specifications, appropriate standards, and will be new and free from defects in material and workmanship. Contractor warrants that all such goods or services will conform to any statements made on the containers, labels, advertisements for such goods or services and that any goods will be adequately, contained, packaged, marked and labeled. Contractor expressly warrants that all goods or services furnished under this standard shall be merchantable, and will be safe and appropriate for the purpose which goods or services of that kind are normally used.

B. The Contractor or solar sub-contractor shall be a licensed electrical Contractor as required within the state or jurisdiction of where the installation work is being conducted. Contractor shall hold all necessary credentials, certifications, licenses, insurances, etc. required by the state of Arizona, City of Bisbee, and APS to complete any solar installation. Furthermore, contractor installing any solar related equipment shall have a five year proven track record of completing at least 10 installations of similar type and size within the state of Arizona, five of which were within the APS service territory. References for two similar projects shall be provided if requested by the City of Bisbee.

1.3 SUBMITTALS

A. Submit below items in conjunction with Master Specification Division 01, Shop Drawings, Product Data, and Samples.

B. Provide certificates of compliance with Section 1.02, Quality Assurance.

C. Prepare and submit APS Onetime Incentive Agreement. Submittal will include, but not limited to the following:

1. Application
2. Signed contract between contractor and City of Bisbee on Contractor's letterhead
3. Customer (City of Bisbee) information as required by APS
4. Any other information as required by APS

D. The City of Bisbee will assign all APS incentive payments (if any) directly to the contractor. It is the contractor's responsibility to complete and submit the "Consent to Assign Incentive Payment to a Third Party" application to APS in a timely manner.

E. Failure to submit the proper applications within the appropriate time frames may result in the contractor forfeiting the incentive payment from APS. The project schedule shall not be delayed to accommodate filing the appropriate paperwork associated with this incentive payment.

F. The contractor shall not include credits or allowances in his bid for receiving or not receiving this incentive payment from APS. All risks associated with receiving the APS incentive payment will be borne solely by the contractor and not the City of Bisbee.

G. Prepare and submit APS Generating Facility Design Drawings per APS requirements within the timeframe specified by APS. Submittal will include, but not be limited to the following:

1. Interconnection Application
2. Single-line diagram
3. Three-line diagram
4. Site Plan
5. Certificate of Liability Insurance

H. Design drawings shall be submitted with adequate time to obtain APS approval prior to the commencement of any work associated with the Photovoltaic system. Contractor shall also be aware of all time constraints for submitting applications and the time requirements for commissioning.

I. All APS design drawings shall be in strict accordance with these specifications and project construction documents. If these documents contradict any requirements of APS, the engineer shall be notified immediately to remedy the discrepancy. Any changes that the engineer deems necessary shall be done at the contractor's expense since it is understood that all equipment shall be supplied and installed per section below.

J. The contractor's bid shall include all equipment, whether it is included in these documents or not, that is required for a fully functional and operational Photovoltaic system that meets APS interconnection requirements. Furthermore, the contractor shall include all the submittals, application preparation, and any design documents that will be required for this project.

K. Contractor shall act as Liaison between City of Bisbee and APS for any agreements that are required between the City of Bisbee and APS. This includes all coordination of the Photovoltaic system installation, commissioning of the system, and all related administrative duties.

L. Prior to Commissioning of the system, contractor shall provide a time to "walk" the solar installation with City of Bisbee representatives and obtain approval from the City of Bisbee to Commission the site.

M. Submit manufacture's certification of Underwriters Laboratories, Inc. (UL) listing as specified. Provide all maintenance and operating manuals to the City of Bisbee.

1.4 WARRANTY OF CONSTRUCTION

A. Unless otherwise specified, all items shall be guaranteed for a minimum period of one (1) year from date of acceptance by the City against defects in material & workmanship. At any time during that period, if a defect should occur in any item that item shall be replaced or repaired by the contractor at no cost to the City of Bisbee except where it is shown that the defect was caused by misuse.

PART 2 - PRODUCTS

1.5 EQUIPMENT

A. DC to AC Inverter

1. Wall mounted inverter with integrated load-break rated lockable DC disconnect switch.
2. Integrated fused series string combiner.
3. Sealed electronics enclosure, NEMA 3R or NEMA 4X.
4. Communications and data collection via RS485, provide interface to connect Inverters to Ethernet Switch in building equipment room, provide communications wires as needed to establish link between inverters and building equipment room.
5. Integral DC Disconnect.
6. Integral Arc-Fault Circuit Interruption
7. 20 year full replacement warranty
8. Certifications: UL 1741, IEEE-1547, FCC Part 15 B compliant
9. Approved Manufacturers:
   a. Power-One – TRIO-20.0-TL-OUTD-S1-US-480-A
   b. SMA Sunny Tripower – STP-20000TL-US-10

10. Inverter shall meet the following technical requirements:

Description	Power-One	SMA
Recommended Maximum PV Power (Module STC)	24,000 W	25,000 W
DC Maximum Voltage	1,000 V	1,000 V
Peak Power Tracking Voltage	450 - 800 V	380 - 800 V
DC Maximum Input Current	60 A	60 A
PV Start Voltage	360 V	150 V
AC Nominal Power	20,000 W	20,000 W
AC Maximum Output Power	22,000 W	20,000 W
AC Maximum Output Current per Phase	27 A	24 A
AC Output Voltage	480 V	480 V
AC Output Phases	3	3
AC Frequency: nominal / range	60 Hz / 57 – 63 Hz	60 Hz / 54 – 65 Hz
Power Factor (Nominal)	0.995	1.0
Peak Inverter Efficiency	98.2%	98.5%

CEC Weighted Efficiency	97.5%	97.5%
Dimensions: H x W x D in inches	41.7" x 27.6" x 11.5"	27.1" x 26.1" x 10.4"
Unit Weight	157 lbs	121 lbs
Ambient Temperature Range	–22 to 140 °F	–13 to 140 °F

B. Photovoltaic Module (Solar Panel)

1. Panels shall have 25-year warranty on performance and 10-year warranty on product workmanship.
2. Consist of series connected polycrystalline silicone cells.
3. Frame shall be constructed of anodized aluminum.
4. Output cables shall have locking plug-in connectors.
5. Certifications: UL 1703
6. Approved Products:
   a. Canadian Solar
   b. Central Solar
   c. Solar World
   d. Or Approved Equal

7. Panels shall meet the following technical requirements:

Description	
Maximum Power (P_{max})	250 W
Voltage at P_{max} (V_{mp})	30.10 V
Current at P_{max} (I_{mp})	8.30 A
Open Circuit Voltage (V_{oc})	37.20 V
Short Circuit Current (I_{sc})	8.87 A
Module Efficiency	15.54%
Short Circuit Temp. Coefficient	5.77 mA/°C
Open Circuit Voltage Temp. Coefficient	-0.13 V/°C
Maximum Series Fuse Rating	15A
Maximum System Voltage	1,000V
Normal Operating Cell Temp. (NOCT)	45°C

Weight	40.8 lbs
Dimensions (L x W x D) inches	64.5x38.7x1.57

C. PV Conductors

1. All exposed conductors between PV panels to be 12 AWG (minimum) copper multi-contact cable, 1000V DC rated, type USE-2/RHW-2 (90°C).
2. All PV ground wires and PV equipment bonds to be sized per single line diagrams.
3. Bond wire must be continuous with laterals to individual devices.

D. Line Voltage Conductors, used in DC Electrical Systems:

1. Copper with AWG sizes as shown:
   a. Minimum size shall be No. 12 except where specified otherwise.
   b. Conductor size No. 8 and larger shall be stranded.

2. Insulation:
   a. Standard Conductor, 1,000V type PV Wire (90 deg C)
   b. Higher temperature insulation as required by NEC or local codes.

E. Mounting Equipment

1. PV module mounting equipment shall be per manufacturer recommendations.
2. Engineered to 50 lbs/sq ft, and to withstand 100 mph wind load.
3. Equipment rails and supports shall be constructed of anodized extruded aluminum. All hardware shall be stainless steel.
4. No diagonal bracing shall be required.
5. Mounting rail system that PV modules attach to must be listed as an equipment-grounding conductor with listed connections, or a rail connecting device must be used to maintain the electrical connection between rail joints. Mounting rail to be connected to the copper equipment-ground by a listed device.
6. Brackets shall have an adjustable angle pivot to accommodate PV module installation at the angle indicated on the plans.

PART 3 - EXECUTION

1.6 INSTALLATION

A. General:

1. All equipment shall be installed in a neat, workmanlike manner and shall be properly mounted and secured in place.

B. Equipment Labeling

1. Label all Photovoltaic System components per equipment labeling notes on the plans.
2. All labels shall be on lamicoid nameplates with 1/4" lettering, unless otherwise noted. Nameplates shall have a minimum 1/32" thickness. Attach to equipment with outdoor rated adhesive supplied by nameplate manufacturer.

- END OF SECTION -

SECTION 16000
COMMON WORK RESULTS FOR ELECTRICAL

PART 1 – GENERAL

1.1 Summary

A. Includes But Not Limited To:

1. General electrical system requirements and procedures.
2. Perform excavating and backfilling work required by work of this Division as described in Contract Documents.
3. Make electrical connections to equipment provided under other Sections.
4. Furnish and install Penetration Firestop Systems at electrical system penetrations as described in Contract Documents.

B. Products Supplied But Not Installed Under This Section:

1. Anchor bolts and templates for exterior lighting equipment bases.

1.2 SUBMITTALS

A. Product Data:

1. Provide following information for each item of equipment:

a. Catalog Sheets.
b. Assembly details or dimension drawings.
c. Installation instructions.
d. Manufacturer's name and catalog number.
e. Name of local supplier.

PROJECT SPECIFIC: Edit listings under following paragraph to correspond with equipment and systems used on Project. Edit Shop Drawing Article where necessary to match.

2. Furnish such information for following equipment:

a. Wiring devices.
b. Enclosed switches and circuit breakers.
c. Panelboards.
d. Exterior lighting fixtures, poles, and associated control equipment.

3. Do not purchase equipment before approval of product data.

B. Shop Drawings:

1. Submit on Panelboards.
2. Indicate precise equipment to be used, including all options specified. Indicate wording and format of nameplates where applicable. Submit in three-ring binder with hard cover.

C. Quality Assurance / Control:

1. Report of site tests, before Substantial Completion.

D. Closeout:

1. Operations And Maintenance Manual Data:

a. Modify and add to requirements of Section 01700 as follows:

1) Provide operating and maintenance instructions for each item of equipment submitted under Product Data.
2) Include copy of approved shop drawings.

1.3 GENERAL PROVISIONS

A. Minimum sizes of equipment, and electrical devices, are indicated but it is not intended to show every offset and fitting, nor every structural or mechanical difficulty that will be encountered during the installation of the work.

B. Work indicated on the Plans is approximately to scale. Actual dimensions and detailed Plans should be followed as closely as field conditions permit. Field verification of scaled dimensions on Plans is governed by field conditions. Installation of systems and equipment is subject to clarifications as indicated in reviewed shop drawings and field coordination.

C. Discrepancies indicated on different Plans, between Plans and actual field conditions, or between Plans and Contract Documents shall be promptly brought to the attention of the ENGINEER for clarification, prior to purchasing and installing equipment.

D. The alignment of equipment and conduit shall be adjusted to accommodate architectural changes, and coordinate with work of other trades, without extra expense to the Owner.

E. The CONTRACTOR shall furnish and install the parts and pieces necessary to the installation of equipment, in accordance with the best practice of the trade, and in conformance with the requirements of these Contract Documents and equipment manufacture's recommendations.

F. Items not specifically mentioned in these Contract Documents, or noted on the Plans, or indicated on reviewed shop drawings, but which are necessary to make a complete working installation, shall be deemed to be included herein.

G. The CONTRACTOR shall lay out and install electrical work prior to completion of floors and walls. Furnish and install sleeves and openings through floors and walls, required for installation of conduits. Sleeves shall be rigidly supported and suitably packed, or sealed, to prevent ingress of wet concrete. Spacers shall be installed in order to prevent conduit movement. Dimensions indicated for electrical equipment and their installation are minimum dimensions.

H. The CONTRACTOR shall furnish and install inserts and hangers required to support conduits and other electrical equipment. If the inserts, hangers, sleeves, or other mounting hardware are improperly placed, or installed, the CONTRACTOR shall do necessary work, at his/her own expense, to rectify the errors.

I. Electrical equipment shall be capable of operating successfully at full-rated load, without failure, at an ambient air temperature of 60 degrees C, and specifically rated for the altitude indicated on the Plans. Electrical equipment not rated for operation at that temperature shall be provided with air conditioning to meet the manufacturers' operating temperature.

J. If any contradictions or inconsistency appears, the strictest criteria noted and the collective requirements in any and all of the project documents shall apply.

K. The CONTRACTOR shall perform necessary saw cutting, core drilling, excavating, removal, shoring, backfilling, and other work required for the proper installation of conduits, whether inside, or outside of the buildings and structures. The CONTRACTOR shall repair and patch where demolition has taken place in a manner to match existing original structure.

1.4 REGULATIONS, CODES, AND STANDARDS

A. Electrical work, including connection to electrical equipment integral with mechanical equipment, shall be performed in accordance with the latest published regulations, codes, and standards, of the following:

1. National Electrical Code (NEC)
2. State and local codes
3. Institute of Electrical and Electronic Engineers (IEEE)
4. American National Standards Institute (ANSI)
5. American Society for Testing and Materials (ASTM)
6. Insulated Cable Engineers Association (ICEA)
7. National Electrical Manufacturers Association (NEMA) Standards
8. Federal Occupational Safety and Health Act (OSHA)
9. National Fire Protection Association (NFPA)
10. National Electrical Testing Association (NETA)

B. When applicable, the material used in the performance of the electrical work shall be listed by the Underwriters' Laboratories, Inc. (UL) for the class of service for which they are intended.

1.5 SUBMITTALS

A. It is the obligation of the CONTRACTOR to organize his/her work, so that a complete electrical, instrumentation, and control system for the facility will be provided, and will be supported by accurate shop and record drawings, and O&M manuals.

B. The CONTRACTOR shall submit detailed shop drawings and data prepared and organized by the suppliers. The quantity of submittal sets required shall be as specified in the Contract Documents.

C. The submittals shall be neatly grouped and organized by specification section number, and sub-section. Related information shall be highlighted, and the specific product shall be indicated. All submittals shall be complete, and presented in one package. Incomplete submittals will be returned without review. If a portion of the project requires a fast track schedule, that portion only may be submitted earlier under a separate cover letter after securing the ENGINEER's written permission. The following shall be submitted to the Engineer and returned, reviewed to the CONTRACTOR before fabrication is started.

1. A complete list of the equipment and materials, including the manufacturer's name, product specification, descriptive data, technical literature, performance charts, catalog cuts, installation instructions, and spare part recommendations for each different item of equipment specified. The above shall clearly show all the specified requirements as described in the Specifications including but not limited to specific U.L. and NEMA rating, technical capabilities, test result verifications, and acceptance letters.
2. Drawings containing complete wiring and schematic diagrams, control diagrams, and any other details required to demonstrate that the system has been coordinated and will operate as intended. Drawings shall show proposed layout, anchoring, support, and appurtenances of equipment, and equipment relationship to other parts of the work including clearances for maintenance and operations.

1.6 RECORD DRAWINGS

A. Upon Project acceptance, the CONTRACTOR shall submit four sets of "Record Drawings" of the electrical, control, and instrumentation, along with step-by-step procedure manuals for the installation, operation start-up, and maintenance of the equipment. Each set shall include installation, operating, troubleshooting, maintenance and overhaul instructions in complete detail. It shall also include possible breakdowns and repairs, and troubleshooting guides, as well as simplified wiring and control diagrams of the system installed. This shall provide the Owner with comprehensive information on all systems and components to enable operation, service, maintenance and repair. Exploded, or other detailed views of all equipment, devices, assemblies, and accessory components shall be included, together with complete parts lists and ordering instructions.

B. The CONTRACTOR shall maintain a marked up set of Contract Document Plans showing actual installed circuit numbers, conduit sizes, cable tray routing, number of conductors, conductor sizes (larger than #12 AWG), and all other deviations from the design Plans.

C. Underground conduit and concealed items shall be dimensioned on the Plans from permanent, visible, building features.

D. The CONTRACTOR shall provide actual motor size, starter size, and overload heater size, along with all other protective equipment for all 480 V and 4160 V motor circuits as part of the one-line record drawings.

E. The CONTRACTOR shall revise all conductor identification and panel schedules to indicate as-built conditions.

PART 2 – PRODUCTS

2.1 GENERAL MATERIALS AND METHODS

A. Materials, equipment, and parts comprising any unit, or part thereof, specified or indicated on the Plans, shall be new and unused, of current manufacture, and of highest grade consistent with the state of the art. Damaged materials, equipment, and parts, are not considered to be new and unused, and will not be accepted.

B. Field verification of scale dimensions on Plans is directed, since actual locations, distances, and levels will be governed by actual field conditions. The CONTRACTOR shall also review architectural, structural, yard, mechanical, and other Plans, and the accepted electrical and mechanical shop drawings, and shall adjust their work to conform to the conditions indicated therein.

C. The fabricator of major components, such as distribution panelboards, switchgear, and motor control centers, shall also be the manufacturer of the major devices therein.

D. Refer to various Division sections for individual equipment manufacturers. Indicated manufacturers are subject to strict compliance with the specifications and complete project documents. The reference to a particular manufacturer does not relieve the CONTRACTOR from conforming to the specified requirements.

2.2 NAMEPLATES

A. Where indicated elsewhere in these specifications, or on the Plans, the CONTRACTOR shall furnish and install nameplates, which shall be black laminate with white letters. The nameplates shall be fastened to the various devices with round head stainless steel screws. Each disconnecting means for service, feeder, branch, or equipment conductors, shall have nameplates indicating its purpose.

2.3 SHOP WORK

A. The assembly of process control panels and/or modifications to equipment assemblies shall be done at a UL approved shop. The entire unit shall be completely assembled and tested prior to shipment to the project site. In addition, owner personnel shall be allowed to inspect the unit(s) prior to job-site shipping. This inspection shall not be construed as final acceptance of unit(s) by the owner.

2.4 LISTED EQUIPMENT ASSEMBLIES

A. Service Entrance equipment, Switchgear, Switchboards, Panelboards, Control and Distribution Panels, and other factory assembled electrical enclosures shall bear a UL label. Custom built electrical enclosures and control panels shall bear a UL508 label. Where UL listing is not available, CSA or ETL shall be considered during submittal review.

2.5 SUBSTITUTION OF MATERIAL AFTER AWARD OF CONTRACT

A. Any exceptions to these specifications shall be submitted to the ENGINEER, with the reasons for requesting such exceptions, with calculations and drawings for redesign of related components, including detailed drawings showing internal and assembly details, with installation instructions. Proposed layout changes showing any modifications or exceptions to related work made necessary by the(se) exception(s), with calculations and drawings showing such modifications or exceptions, shall also be included.

B. Items if material and equipment may be offered (at the CONTRACTOR's option) as alternates to specified items. Such offer shall be in writing under Bidder's letterhead.

C. Such alternate proposals shall be accompanied by full descriptive data on the proposed equipment. If alternate material proposals are considered, the CONTRACTOR shall submit a list of the proposed alternate substitution items in accordance with the requirements of "Review of Proposed Substitutions".

PART 3 – EXECUTION

3.1 UTILITY SERVICE AND EQUIPMENT

A. ELECTRICAL UTILITY

1. The CONTRACTOR shall be responsible for contacting and coordinating the electrical utility work with the electrical utility company. The CONTRACTOR shall be responsible for furnishing and installing equipment and material required to bring electrical power service to the service location in conformance with the electrical utility requirements. The CONTRACTOR may have to provide the following for the electrical utility company's primary (from utility power line to the utility transformer) and secondary (from utility transformer to the service) electrical lines in accordance with the electrical utility company's specifications and requirements:

    a. Conduits (verify quantity and sizes)
    b. Trenching, backfill, and compacting (verify trench size(s), backfill material, and compaction percentage requirements)
    c. Concrete pad(s) (for pad mounted transformer(s))
    d. Cable protection along the vertical drop at the utility company's pole (if pole mounted transformer(s))
    e. Other items required by the power utility company

f. The CONTRACTOR shall also submit copies of service entrance shop Drawings to the utility, per utility submittal requirements, prior to submittal to the ENGINEER. The CONTRACTOR shall obtain written approval from the power utility company that the service entrance equipment is acceptable prior to release the order to the supplier for fabrication. A copy of the approval letter from the utility shall be transmitted to the ENGINEER along with the submittal.

3.2 INSTALLATION OF ELECTRICAL EQUIPMENT

A. Coordinate the installation of electrical equipment with other trades.

1. Arrange for the building in of equipment during structure construction.
2. Where equipment cannot be built-in during construction, arrange for sleeves, box-outs, and other openings, as required to allow installation of equipment after structure construction is complete.

B. Verify that equipment will fit support layouts indicated.

C. **Equipment Dimensions and Clearances:**

1. Do not use equipment that exceeds the indicated dimensions., except as approved in writing by the ENGINEER.
2. Do not use equipment or arrangements of equipment that reduce required clearances or exceed the space allocation.

D. Install equipment in accordance with the manufacturer's instructions.

E. **Equipment Access:**

1. Install equipment so it is readily accessible for operation and maintenance.
2. Equipment shall not be blocked or concealed.
3. Do not install electrical equipment such that it interferes with normal maintenance requirements of other equipment.

F. Equipment shall be installed plumb, square and true with the building construction, and shall be securely fastened.

G. Outdoor wall-mounted equipment, and indoor equipment mounted on earth, or water bearing walls, shall be provided with corrosion-resistant spacers to maintain %-inch separation between the equipment and the wall.

H. Screen or seal all openings into outdoor equipment to prevent the entrance of rodents and insects.

I. Equipment fabricated from aluminum shall not be imbedded in earth or concrete.

J. **Provide all necessary anchoring devices and supports:**

1. Use supports as detailed on the Plans and as specified.
2. Supports and anchoring devices shall be rated and sized based on dimensions and weights verified from approved equipment submittals.
3. Hardware shall be stainless steel.
4. Do not cut, or weld to, building structural members.
5. Do not mount safety switches and external equipment to other equipment enclosures, unless enclosure mounting surface is properly braced to accept mounting of external equipment.

K. CONTRACTOR shall verify exact rough-in location and dimensions for connection to electrical items

furnished by others.

1. Shop drawings shall be obtained from those furnishing the equipment.
2. Proceeding without proper information may require the CONTRACTOR to remove and replace work that does not meet the conditions imposed by the equipment supplied.
3. Provide sleeves wherever openings are required through new concrete or masonry members. Place sleeves accurately and coordinate locations with the ENGINEER.
4. Should any cutting and patching be required on account of failure of the CONTRACTOR to coordinate penetrations, such cutting and patching shall be done at the expense of the CONTRACTOR.

    a. The CONTRACTOR shall not endanger the stability of any structural member by cutting, digging, chasing, or drilling and shall not, at any time, cut or alter the work without the ENGINEER's written consent.

        1) Provide additional reinforcing if required.
        2) Cutting shall be done neatly using proper tools and methods.

    b. Subsequent patching to restore walls, ceilings, or floors to their original condition shall be done by the CONTRACTOR.

L. Provide concrete foundations or pads required for electrical equipment as indicated or specified.

1. Floor-mounted equipment shall be mounted on a 4-inch concrete housekeeping pad. Pad shall be poured on top of the finished floor or slab.

3.3 TEMPORARY POWER

A. The CONTRACTOR shall furnish, install, and maintain, temporary power and lighting systems needed for construction. This temporary system shall include weatherproof panel(s) for the CONTRACTOR's main breakers and distribution system. Ground fault interrupting equipment shall be installed. Connections shall be watertight, with wiring done with Type SO portable cable. After construction is completed, the CONTRACTOR shall remove temporary power equipment and devices.

3.4 CUTTING AND REPAIRING

A. Where it becomes necessary to cut into existing work for the purpose of making electrical installations, core drills shall be used for making circular holes. Other demolition methods for cutting or removing shall be reviewed by the ENGINEER prior to starting the work.

B. The CONTRACTOR shall repair damage caused by construction, or demolition work, and restore damaged areas to original condition.

3.5 CORROSION PROTECTION

A. Wherever dissimilar metals, except conduit and conduit fittings, come in contact, the CONTRACTOR shall isolate these metals, as required, with neoprene washers, 9 mil polyethylene tape, or gaskets. Where fastening conduit, electro plated, or equivalent fasteners and stainless steel bolts shall be used.

B. Factory finishes damaged during shipping, or construction, shall be restored to original new condition. Rust shall be removed, and bare metal surfaces shall be primed and painted to match the original surrounding finish.

C. Electrical panels, switchgear, motor control centers, and other electrical equipment, shall be shipped in sealed dust and moisture proof plastic sheet enclosures, and the seal maintained until units are installed. Said units shall be new and free of any dirt, dust, water, grease, rust, damaged parts or components. Relays, starters, circuit breakers, switches, contacts, insulators, mechanisms, and buses shall be free of dust, dirt, oil, moisture, metal shavings, and other debris before testing and energizing.

D. Once equipment is installed, it shall be protected at all times with plastic sheet covers until the area is free of dirt, dust, paint spray, water, and other trades. Heat shall be provided to eliminate condensation.

3.6 COORDINATION OF THE ELECTRICAL SYSTEM

A. The CONTRACTOR shall verify actual equipment, and motor full-load, and locked-rotor current ratings. The necessary minimum equipment, wire, and conduit sizes are indicated on the Plans. If the CONTRACTOR furnishes equipment of different ratings, the CONTRACTOR shall coordinate the actual current rating of equipment furnished with the branch circuit conductor size, the overcurrent protection, the controller size, the motor starter, and the branch circuit overcurrent protection. The branch circuit conductors shall have a current carrying capacity of not less than 125 percent of the actual full-load current rating.

3.7 TEST

A. The electrical work shall be free from improper grounds, and from short circuits. The correctness of the wiring shall be verified first by visual comparison of the conductor connections with connection diagrams. Next, individual circuit continuity checks shall be made by using electrical circuit testers. Last, the correctness of the wiring shall be verified by the actual electrical operation of the electrical and mechanical devices. Any deviation from the wiring indicated on the Plans, or accepted Drawings, shall be corrected and indicated on the record drawings.

B. Each conductor shall be identified as required by the Contract Documents. This identification shall be indicated on the record drawings to enable rapid and accurate circuit tracing by maintenance personnel.

3.8 SINGLE LINE DIAGRAMS

A. Single line diagrams, as indicated on the Drawings, show circuit voltages, circuit protection rating, and other pertinent data. Where conflicts exist on the Drawings, the single line diagrams shall take precedence. Grounding conductors are not necessarily indicated. See grounding requirements specified elsewhere herein.

- END OF SECTION -

SECTION 16111
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:

1. Quality of material and installation procedures for raceway, boxes, and fittings used on Project but furnished under other Divisions.
2. Furnish and install raceway, conduit, and boxes used on Project not specified to be installed under other Divisions.
3. Furnish and install main telephone service raceway as described in Contract Documents and to comply with telephone company requirements.
4. Furnish and install main electrical service raceway to comply with electrical utility company requirements.

B. Related Sections

1. Section 16000: Common Work Results For Electrical

PART 2 – PRODUCTS

2.1 COMPONENTS

A. Raceway And Conduit:

1. Sizes:

a. 3/4 inch to 4 inch for exterior underground use.
b. 1/2 inch minimum elsewhere, unless indicated otherwise.

2. Types: Usage of each type is restricted as specified below by product.

a. Galvanized rigid steel or galvanized intermediate metal conduit (IMC) is allowed for use in all areas. Where in contact with earth or concrete, half lap wrap buried galvanized rigid steel and galvanized IMC conduit and fittings completely with vinyl tape.
b. Galvanized Electrical Metallic Tubing (EMT), Flexible Steel Conduit, And Metal-Clad Cable (Type MC):

1) Allowed for use only in indoor dry locations where it is:

a) Not subject to damage.
b) Not in contact with earth.
c) Not in concrete.

2) Flexible steel conduit or metal-clad cable required for final connections to indoor mechanical equipment.

c. Schedule 40 Polyvinyl Chloride (PVC) Conduit:

1) Allowed for use only underground or below concrete with galvanized rigid steel or IMC elbows and risers.
2) Schedule 40 PVC elbows may be used to sweep into exterior ingrade pull boxes.

d. Listed, Liquid-Tight Flexible Metal Conduit:

1) Use in outdoor final connections to mechanical equipment, length not to exceed 36 inches.

e. Pre-wired 3/8 Inch Flexible Fixture Whips: Allowed only for connection to recessed lighting fixtures, lengths not to exceed 72 inches.
f. Electrical Non-Metallic Tubing (ENT): Allowed for use only as a raceway for control voltage cables in concealed or inaccessible, indoor, dry locations.

3. Prohibited Raceway Materials:

a. Aluminum conduit.
b. Armored cable type AC (BX) cable.

B. Raceway and Conduit Fittings:

1. Rigid Steel Conduit and IMC: Threaded and designed for conduit use.
2. EMT:

a. Compression type.
b. Steel set screw housing type.

3. PVC Conduit:

a. PVC type. Use PVC adapters at all boxes.
b. PVC components, (conduit, fittings, cement) shall be from same Manufacturer.

4. Flexible Steel Conduit: Screw-in type.
5. Liquid-tight Flexible Metal Conduit: Sealtite type.
6. Expansion fittings shall be equal to OZ Type AX sized to raceway and including bonding jumper.
7. Prohibited Fitting Materials:

a. Crimp-on, tap-on, indenter type fittings.
b. Cast set-screw fittings for EMT.
c. Spray (aerosol) PVC cement.

C. Outlet Boxes:

1. Galvanized steel of proper size and shape are acceptable for all systems. Where metal boxes are used, provide following:

a. Provide metal supports and other accessories for installation of each box.
b. Equip ceiling and bracket fixture boxes with fixture studs where required.
c. Equip outlets in plastered, paneled, and furred finishes with plaster rings and extensions to bring box flush with finish surface.

2. Plastic boxes may be used only in low voltage systems where conductors are not installed in conduit.

3. Telephone / data outlet boxes shall be single device outlet boxes.
4. HVAC Instrumentation and Control:

    a. Junction boxes in mechanical equipment areas shall be 4 inches square.
    b. Boxes for remote temperature sensor devices shall be recessed single device.
    c. Boxes for thermostats shall be 4 inches square with raised single device cover.

2.2 MANUFACTURERS

A. Contact Information:

1. Cooper B-Line, Highland, IL www.bline.com.
2. Hubbell Incorporated, Milford, CT www.hubbell-wiring.com.
3. Square D, Palatine, IL www.squared.com.
4. Steel City, Div Thomas & Betts, Memphis, TN www.tnb.com.
5. Thomas & Betts, Memphis, TN www.tnb.com.
6. Walker Systems Inc, Williamstown, PA www.wiremold.com.
7. Wiremold Co, West Hartford, CT www.wiremold.com.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Confirm dimensions, ratings, and specifications of materials to be installed and coordinate these with site dimensions and with other Sections.

3.2 INSTALLATION

A. Interface With Other Work:

1. Coordinate with Divisions 22 and 23 for installation of raceway for control of plumbing and HVAC equipment.
2. Before rough in, verify locations of boxes with work of other trades to insure that they are properly located for purpose intended.

    a. Coordinate location of outlet for water cooler with Division 22.
    b. Coordinate location of outlets adjacent to or in millwork with Division 06 before rough-in. Refer conflicts to Architect and locate outlet under his direction.

3. Install pull wires in raceways installed under this Section where conductors or cables are to be installed under other Divisions.

B. Conduit And Raceway:

1. Conceal raceways within ceilings, walls, and floors, except at CONTRACTOR's option, conduit may be exposed on walls or ceilings of mechanical equipment areas and above acoustical panel suspension ceiling systems. Install exposed raceway runs parallel to or at right angles to building structure lines.
2. Keep raceway runs 6 inches minimum from hot water pipes.
3. Make no more than four quarter bends, 360 degrees total, in any conduit run between outlet and outlet, fitting and fitting, or outlet and fitting.

a. Make bends and offsets so conduit is not injured and internal diameter of conduit is not effectively reduced.
b. Radius of curve shall be at least minimum indicated by NEC.

4. Cut conduit smooth and square with run and ream to remove rough edges. Cap raceway ends during construction. Clean or replace raceway in which water or foreign matter have accumulated.
5. Install insulated bushings on each end of raceway 1-1/4 inches in diameter and larger, and on all raceways where low voltage cables emerge. Install expansion fittings where raceways cross building expansion joints.
6. Install insulated bushings on each end of raceway 1-1/4 inches in diameter and larger. Install expansion fittings where raceways cross building expansion joints.
7. Run two spare conduits from each new panelboard to ceiling access area or other acceptable accessible area and cap for future use.
8. Bend PVC conduit by hot box bender and, for PVC 2 inches in diameter and larger, expanding plugs. Apply PVC adhesive only by brush.
9. Installation In Framing:

   a. Do not bore holes in joists or beams outside center 1/3 of member depth or within 24 inches of bearing points. Do not bore holes in vertical framing members outside center 1/3 of member width.
   b. Holes shall be one inch diameter maximum.

10. Underground Raceway And Conduit:

    a. Bury underground raceway installed outside building 24 inches deep minimum.
    b. Bury underground conduit in planting areas 18 inches deep minimum. It is permissible to install conduit directly below concrete sidewalks, however, conduit must be buried 18 inches deep at point of exit from planting areas.

11. Conduit And Raceway Support:

    a. Securely support raceway with approved straps, clamps, or hangers, spaced as required.
    b. Do not support from mechanical ducts or duct supports without Architect's written approval. Securely mount raceway supports, boxes, and cabinets in an approved manner by:

       1) Expansion shields in concrete or solid masonry.
       2) Toggle bolts on hollow masonry units.
       3) Wood screws on wood.
       4) Metal screws on metal.

12. Prohibited Procedures:

    a. Use of wooden plugs inserted in concrete or masonry units for mounting raceway, supports, boxes, cabinets, or other equipment.
    b. Installation of raceway that has been crushed or deformed.
    c. Use of torches for bending PVC.
    d. Spray applied PVC cement.
    e. Boring holes in truss members.

f. Notching of structural members.
g. Supporting raceway from ceiling system support wires.
h. Nail drive straps or tie wire for supporting raceway.

C. Telephone / Data Systems:

1. Install main service raceway as directed by Telephone Company. Leave pull wire in raceway.
2. Install raceway from terminal board to each telephone and data outlet unless indicated otherwise on Drawings.

D. Boxes:

1. Boxes shall be accessible and installed with approved cover.
2. Do not locate device boxes that are on opposite sides of framed walls in the same stud space. In other wall construction, do not install boxes back to back.
3. Locate boxes so pipes, ducts, or other items do not obstruct outlets.
4. Install outlets flush with finished surface and level and plumb.
5. Support switch boxes larger than two-gang with side brackets and steel bar hangers in framed walls.
6. At time of substantial completion, install blank plates on uncovered outlet boxes that are for future use.
7. Install air / vapor barrier back boxes behind outlet boxes that penetrate vapor barrier.
8. Location:

a. Install boxes at door locations on latch side of door, unless explicitly shown otherwise on Drawings. Verify door swings shown on electrical drawings with architectural drawings, and report discrepancies to Architect before rough in. Distance of box from jamb shall be within 6 inches of door jamb.
b. Properly center boxes located in walls with respect to doors, panels, furring, trim and consistent with architectural details. Where two or more outlets occur, space them uniformly and in straight lines with each other, if possible.
c. Center ceramic tile boxes in tile.

- END OF SECTION -

SECTION 16123
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 –GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:

1. Quality of conductors used on Project except as excluded below.

B. Related Sections:

1. Section 16000: Common Work Results for Electrical

1.2 DEFINITIONS

A. Line Voltage: Over 70 Volts.

PART 2 – PRODUCTS

2.1 COMPONENTS

A. Line Voltage Conductors, used in AC Electrical Systems:

1. Copper with AWG sizes as shown:

a. Minimum size shall be No. 12 except where specified otherwise.
b. Conductor size No. 8 and larger shall be stranded.

2. Insulation:

a. Standard Conductor Size No. 10 and Smaller: 600V type XHHW (75 deg C).
b. Standard Conductor Size No. 8 and Larger: 600V Type XHHW-2 (75 deg C min).
c. Higher temperature insulation as required by NEC or local codes.

3. Colors:

a. 240 / 120 V System:

1) Black: Phase A
2) Red: Phase B
3) Green: Ground
4) White: Neutral

b. 208Y / 120 V System:

1) Black: Phase A
2) Red: Phase B
3) Blue: Phase C
4) Green: Ground

5) White: Neutral

c. 480Y / 277 Volt System:

1) Brown: Phase A
2) Orange: Phase B
3) Yellow: Phase C
4) Green: Ground
5) Gray: Neutral.

d. Conductors size No. 10 and smaller shall be colored full length. Tagging or other methods for coding of conductors size No. 10 and smaller not allowed.
e. For feeder conductors larger than No. 10 at pull boxes, gutters, panels, and all splice points, use painted or taped band or color tag color-coded as specified above.

B. Standard Connectors, used in AC Electrical Systems:

1. Conductors No. 8 And Smaller: Steel spring wire connectors.
2. Conductors Larger Than No. 8: Pressure type terminal lugs.
3. Connections Outside Building: Make all underground cable and conductors splices in a pull box or j-box, connect and insulate splices with a Tyco Electronics Gelcap-SL or NSI Industries ESSLK-2/0; or connected with copper compression H-tap connector or approved equal and insulated with 3M Scotchcast splice kit 85 series, Tyco Electronics Gelcap SL, or NSI Industries GSS Series.

C. Terminal blocks for tapping conductors, used in AC Electrical Systems:

1. Terminals shall be suitable for use with 75 deg C copper conductors.
2. Acceptable Products:

a. 16323 by Cooper Bussmann, St Louis, MO www.bussmann.com
b. LBA363106 by Square D Co, Palatine, IL www.squared.com.
c. Equal as approved by ENGINEER before bidding.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General:

1. Conductors and cables shall be continuous from outlet to outlet.
2. Do not use direct burial cable.

B. Line Voltage Conductors (Over 70 Volts):

1. Install conductors in raceway except where specifically indicated otherwise. Run conductors of different voltage systems in separate conduits.
2. Route circuits at own discretion, however, circuiting shall be as shown in Panel Schedules. Group circuit homeruns to panels as shown on Drawings.
3. Neutrals:

a. Run separate neutrals for each circuit.
b. Neutral conductors shall be of same size as phase conductors unless specifically noted

otherwise.

4. Pulling Conductors:

   a. Do not pull conductors into conduit until raceway system is complete and cabinets and outlet boxes are free of foreign matter and moisture.
   b. Do not use heavy mechanical means for pulling conductors.
   c. Use only listed wire pulling lubricants.

- END OF SECTION -

SECTION 16160
ELECTRICAL CABINETS AND ENCLOSURES

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. This section covers the service entrance section and related service equipment.

1.2 SUBMITTALS

A. Products shall be submitted in accordance with Section 16000, and elsewhere in the Contract Documents, prior to installation.

B. The contractor shall submit shop drawings, catalog cuts, single line diagrams, component layout drawings and equipment elevation. Shop drawings must indicate all ratings, bus bracing, phasing, and utility requirements.

C. Catalog cuts must be submitted for the service entrance section and components within. Each catalog cut must be properly identified with catalog number and indexed for easy reference.

D. Single line diagrams must be complete with circuit numbers to match the Plans. Components must be sized and shown in a bill of materials.

E. A wiring diagram must be submitted to show connection and control of devices such as ground fault protection, phase protection relays, and other components. Wiring diagram must include component numbers, matching the bill of materials.

F. Service entrance section must be approved for connection by the serving utility company prior to ENGINEER's review.

G. The SES must be UL, CSA, ETI listed as a complete assembly suitable for Service Entrance Duty.

PART 2 – PRODUCTS

2.1 SERVICE ENTRANCE SECTION (SES)

A. The SES shall be a single panel, frame or assembly of panels on which shall be mounted on a deadfront mounting plate, circuit breakers or fused switches, metering equipment and any monitoring or protection devices as indicated on the plans.

B. The SES shall be a one-piece enclosure with front accessibility unless otherwise required. The SES shall have a metered distribution section complete with meter socket and factory installed test blocks, customer metering, and a pull section, overhead or underground, as indicated on the plans; all of which shall comply with the requirements of the serving utility.

C. The enclosure shall be zinc coated steel, minimum 12 gauge thickness. Cabinet shall be protected against corrosion in accordance with U.L. 50, Cabinets and Boxes, Section 13. Exterior covers to be minimum 14 gauge steel, and shall have padlocking provisions. Dead front shall be a hinged type, 16 gauge minimum, and shall not require the use of a tool to expose interior components for installation or servicing. Factory installed components shall be U.L. listed. Factory installed conductors shall be copper, size and type to conform to NEC and U.L. requirements (minimum size #14 AWG). Construction shall be such to prevent the entry of rodents into the interior. Ventilation openings shall be provided.

D. Unless otherwise indicated on the Plans, the enclosure shall be rated NEMA 3R for outdoor use, or NEMA 1A for indoor use.

E. Bus bars (including neutral and ground) shall be silver or tin plated solid copper, and braced to withstand short circuit amps as indicated on the Plans.

F. The SES shall have a steel nameplate stamped indicating the equipment voltage, amperage and short circuit withstand rating, mounted on the outside of the enclosure.

G. Padlocking provisions shall be provided to lock the device in the "OFF" position.

H. The overcurrent protection shall be rated as indicated, and as specified elsewhere herein.

I. Metering and instrumentation shall be as indicated, and as specified elsewhere herein.

J. On circuit breakers 800 amps and larger, a trip button shall be provided.

K. The engineered Service Entrance Section shall be fabricated by the manufacturer of the major components therein, such as circuit breakers, panelboards, components and housing. The manufacturer shall comply with the equipment specifications contained elsewhere in these Contract Documents.

L. The Service Entrance Section shall be as manufactured by Cutler-Hammer, Square D, General Electric, Siemens, or equal.

PART 3 – EXECUTION

3.1 INSTALLATION

A. The Service Entrance Section shall be installed per manufacturer's instructions, as indicated on the plans, per all applicable NEC and local codes and regulations, and shall comply with serving utility's requirements.

B. Grounding shall be provided as required by the NEC, and as indicated on the Plans.

C. Ground resistance testing shall be performed and report submitted per Section 16170.

- END OF SECTION -

SECTION 16170
GROUNDING

PART 1 – GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:

1. Furnish and install grounding for electrical installation as described in Contract Documents except as excluded below.

B. Related Sections:

1. Section 16000: Common Work Results for Electrical

PART 2 – PRODUCTS

2.1 COMPONENTS

A. Size materials as shown on Drawings and in accordance with applicable codes.

B. Grounding and Bonding Jumper Conductors: Bare copper or with green insulation.

C. Make grounding conductor connections to ground rods and water pipes using approved bolted clamps listed for such use.

D. Service Grounding Connections And Cable Splices:

1. Make by exothermic process.
2. Type One Acceptable Products:

a. 'Cadweld' by Erico Products Inc, Solon, OH www.erico.com
b. 'ThermOweld' by Continental Industries, Omaha, NB www.conind.com
c. Equal as approved by Architect before bidding.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Interface with Other Work: Coordinate with Division 03 in installing grounding conductor and placing concrete. Do not allow placement of concrete before Architect's inspection of grounding conductor installation.

B. Grounding conductors and bonding jumper conductors shall be continuous from terminal to terminal without splice. Provide grounding for following.

1. Electrical service, its equipment and enclosures.
2. Conduits and other conductor enclosures.
3. Neutral or identified conductor of interior wiring system.
4. Main panelboard, power and lighting panelboards.

5. Non-current-carrying metal parts of fixed equipment such as motors, starter and controller cabinets, instrument cases, and lighting fixtures.

C. Grounding connection to main water supply shall be accessible for inspection and made within 6 inches of point of entrance of water line to building. Provide bonding jumpers across water meter and valves to assure electrical continuity.

D. Provide concrete-encased electrode system by embedding 25 feet minimum of No. 4 bare copper conductor in concrete footing, 2 inches minimum below concrete surface. Extend No. 4 copper conductor to building panel as shown on Drawings.

E. Ground identified common conductor of electrical system at secondary side of main transformer supplying building. Ground identified grounded (neutral) conductor of electrical system on supply side of main service disconnect.

F. Pull grounding conductors in non-metallic raceways, in flexible steel conduit exceeding 72 inches in length, and in flexible conduit connecting to mechanical equipment.

G. Provide grounding bushings on all feeder conduit entrances into panelboards and equipment enclosures.

H. Bond conduit grounding bushings to enclosures with minimum #10 AWG conductor.

I. Connect equipment grounds to building system ground.

1. Use same size equipment grounding conductors as phase conductors up through #10 AWG.
2. Use NEC Table 250 95 for others unless noted otherwise in Drawings.

J. Run separate insulated grounding cable from each equipment cabinet to electrical panel. Do not use intermediate connections or splices. Affix directly to cabinet.

K. On motors, connect ground conductors to conduit with approved grounding bushing and to metal frame with bolted solderless lug.

L. Do not bond neutral conductor of emergency generator set to set frame at generator location.

M. Ground cabinet of transformers to conduit and ground wires, if installed. Bond transformer secondary neutral conductor to cabinet.

3.2 FIELD QUALITY CONTROL

A. Inspections: Notify Architect for inspection two days minimum before placing concrete over grounding conductor.

-END OF SECTION -

SECTION 16500
EXTERIOR LIGHTING

PART 1 – GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:

1. Furnish and install exterior lighting system as described in Contract Documents.

B. Products Supplied But Not Installed Under This Section:

1. Anchor bolts.

C. Related Sections:

1. Section 16000: Common Work Results for Electrical

PART 2 – PRODUCTS

2.1 EQUIPMENT

A. Exterior Fixtures:

1. Color shall be as indicated on the Construction Documents.
2. Type One Acceptable Products:

    a. As indicated on Fixture Schedule. Do not mix fixtures from different manufacturers for one use.
    b. Equals as approved by ENGINEER before bidding. All proposed equals shall be submitted to the ENGINEER no less than two weeks prior to bid close.

3. LED Luminaires and Fixtures shall meet the following requirements:

    a. LED fixture shall have a 5 year full replacement warranty on LED modules and drivers and a 5 year warranty on finish.
    b. Housing shall be primarily constructed of corrosion-resistant die cast aluminum with powder coated finish to a minimum of 2.5 mil thickness with color as specified in drawings.
    c. All mounting hardware shall be non-corrosive or suitable protected metal.
    d. Driver and LED modules shall have plug connections and be replaceable as separate units.
    e. Cooling shall be done with heat sinks. No fans, pumps, or liquids shall be used.
    f. Unit shall be tested and capable of operating in ambient temperatures or -7°C to 50°C.
    g. Correlated Color Temperature (CCT) of 4000k (± 1000).
    h. Color Rendering Index (CRI) of 70 or greater.
    i. Have L70 rated life of 80,000 hours minimum at 25°C.
    j. LED Drivers shall be Universal type with operating voltage of 110V-277V, 60Hz, power factor >0.90, Total Harmonic Distribution <20% and meet applicable FCC guidelines for interference.
    k. Luminaries must have photometric calculations performed by the ENGINEER and be acceptable to the city. Manufacturer shall supply electronic IES files for the fixture to the ENGINEER. Photometric files must be absolute values and independently verified.
    l. Luminaires must be tested and comply with IESNA LM 79 and LM 80.

m. Shall be UL listed for wet locations.
n. Integral 8kV surge suppression protection standard. Surge protection tested in accordance with IEEE C62.41.2 and ANSI standard 62.41.2.
o. Integral terminal strip for easy power hook-up.
p. Light distribution shall meet IESNA as specified on the plans and shall be full cut-off.
q. Weight shall not exceed 50 lbs. EPA shall not exceed 1.5 Square Feet.

B. Area Lighting Poles:

1. Designed for wind loading required for Project location as determined by ENGINEER.
2. Include hand hole with cover at pole base.
3. Finish and Color: See plans for accepted finish and color.

C. Exterior Lighting Control:

1. Time Switch:

a. Standard 24-hour digital time switch, 120 volts, NEMA 1 enclosure with 2 circuit capability.
b. Category Four Approved Products.

ii. Intermatic
iii. Paragon
iv. Tork

1. Photo Cell-120 volts:

a. Category Four Approved Products.

i. Intermatic: K4121
ii. Paragon: CW201-00
iii. Tork: 2101

2. Lighting Contactor:

a. 120 volt coil, 20 amps, number of poles as indicated in Construction Documents, NEMA 1 enclosure.
b. By same manufacturer as building panelboard.
c. Category Four Approved Products.

i. Cutler Hammer: CN35
ii. General Electric: CR260L-21CA22
iii. Siemens: CLH1B4212A803
iv. Square D: Class 8903, Type LG-20

2.2 MANUFACTURERS

A. Contact Information:

1. See plans for accepted manufactures.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Interface With Other Work: Coordinate location of anchor bolts and conduit in concrete bases so pole will be properly mounted and centered on base.

B. Lighting Control:

1. For Exterior lighting, locate twistlock photocell in light fixture per manufacturer's requirements.

- END OF SECTION -