CITY OF PHOENIX, ARIZONA
OFFICE OF THE CITY ENGINEER

PROJECT SPECIFICATIONS AND CONTRACT DOCUMENTS

91ST AVENUE WASTEWATER TREATMENT PLANT
SLUDGE SOLAR DRYING BEDS
5615 S. 91ST AVENUE, TOLLESON, AZ 85043

PROJECT NO. WS90100098-1

MAYOR
GREG STANTON

CITY COUNCIL
DISTRICT NO.1 - THELDA WILLIAMS
DISTRICT NO. 2 - JIM WARING
DISTRICT NO. 3- DE RA STARK
DISTRICT NO. 4 - LAURA PASTOR
DISTRICT NO. 5 - DANIEL VALENZUELA
DISTRICT NO. 6 - SAL DICICCIO
DISTRICT NO. 7 - MICHAEL NOWAKOWSKI
DISTRICT NO. 8 - KATE GALLEGRO

CITY MANAGEMENT
CITY MANAGER
CITY ENGINEER

ED ZUERCHER
KINI L. E. KNUDSON, PE

EXPIRES 09/30/2019
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PROJECT NO.: WS90100098-1

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CERTIFICATE NO.
29313
MARIA J.
BRADY
EXPIRES 09/30/2017

[Stamp]
CALL FOR BIDS

CITY OF PHOENIX
91ST AVENUE WASTEWATER TREATMENT PLANT SOLAR DRYING BEDS
DESIGN-BID-BUILD

PROJECT NO. WS90100098-1

BIDS WILL BE DUE: TUESDAY, FEBRUARY, 27, 2018 AT 2:00 P.M., LOCAL TIME
PHOENIX CITY HALL
200 W. WASHINGTON STREET, 6th FLOOR
PHOENIX, AZ. 85003-1611

The City of Phoenix is seeking a qualified construction contractor to perform the project listed below.

SCOPE OF WORK

This project is the reconstruction of at least one existing sludge drying bed at the 91st Ave. Wastewater Treatment Plant. The construction project for the work to be performed includes the following:

- Demolition and clearing of area occupied by future 91st Ave. WWTP drying bed No. 57
- Construction of new solar drying bed No. 57 including drying bed grading and paving
- Construction of decant/drainage boxes within the new drying bed No. 57
- Construction of new drainage piping from drying bed No. 57 to Decant Pump Station No. 2
- Paving and grading of access road to the sludge drying bed No. 57
- Bid additive item includes:
  - Bid Alternate A: Clearing and miscellaneous demolition in the area of the existing drying bed No. 31, grading and paving of drying bed No. 31, construction of new decant/drainage box, and drainage piping.
  - Bid Alternate B: Improvements to the existing Decant Pump Station No. 2 including replacing the pumps, mechanical equipment, and electrical and instrumentation improvements.
  - Bid Alternate C: Paving and grading of access road to the solar drying bed No. 57
  - Bid Alternate D: (selected if Bid Alternate C is not selected) adding engineered fill in access road locations to solar drying bed No. 57 in lieu of 7.5” of AC pavement.

The Engineer’s Estimate is $5,000,000 to $6,100,000.

A Small Business Enterprise goal of 2% has been established for this project.

PRE-BID MEETING AND PRE-BID SITE VISIT

A pre-bid meeting will be held on Thursday, February 1, 2018, at 2:00 p.m., local time, at Phoenix City Hall, 5W Conference Room, located at 200 W. Washington Street, 5th Floor, Phoenix, AZ. At this meeting, staff will discuss the scope of work, general contract issues and respond to questions from the attendees. As City staff will not be available to respond to individual inquiries regarding the project scope outside of this pre-bid meeting, it is strongly recommended that interested firms send a representative to the pre-bid meeting.

A pre-bid site visit will be held on Tuesday, February 6, 2018, at 10:00 a.m., local time at the 91st Avenue Wastewater Treatment Plant, located at 5615 South 91st Avenue, Tolleson, AZ 85353. REQUIREMENT TO GAIN ENTRY: ALL ATTENDEES MUST BE PRE-APPROVED. To obtain pre-approval, provide your name, company name, address and contact information by Friday, February 2, 2018, 12:00 p.m., local time to Debra Russell, Contract Specialist. Email Debra.Russell@phoenix.gov

C.F.B.-1
SITE VISIT REQUIREMENT: Attendees must have a valid US Government issued identification (driver’s license or passport) to enter the plant. Attendees must meet and enter at the North gate and be escorted to the project site within the plant. Late arrivals may not be allowed entry.

REQUEST FOR BID PACKET

The bid packet will be available for download on the City of Phoenix Design and Construction Procurement’s “Current Opportunities” web page as of Thursday, January 25, 2018. The web address is:

https://www.phoenix.gov/streets/procurement/current-opportunities

Firms receiving a copy of the bid packet through any other means must download the bid packet from the City webpage and register as a plan holder for the project. The plan holder list is available for viewing within the project folder.

GENERAL INFORMATION

The City reserves the right to award the contract to the lowest responsible responsive bidder or all bids will be rejected, as soon as practicable after the date of opening bids.

The City of Phoenix will provide reasonable accommodations for alternate formats of the bid packet by calling Debra Russell at (602) 256-3444 or calling TTY System (602) 256-4286. Requests will only be honored if made within the first week of the advertising period. Please allow a minimum of seven calendar days for production.

Questions pertaining to process or contract issues should be directed to Contract Specialist, Debra Russell at (602) 256-3444 or email (preferred) Debra.Russell@phoenix.gov.

Ed Zuercher, City Manager
Kini L. E. Knudson, PE, City Engineer

Published: Arizona Business Gazette
Date: January 25, 2018
Date: February 1, 2018
(District 7)
INFORMATION FOR BIDDERS

1. **102 BIDDING REQUIREMENTS AND CONDITIONS.** Add the following to MAG and COP Supplement to MAG Section 102 BIDDING REQUIREMENTS AND CONDITIONS:

INFORMATION FOR BIDDERS

A. **QUESTIONS ON PLANS AND SPECIFICATIONS**

Neither the Engineer nor the City of Phoenix will be held responsible for any oral instructions. Any changes to the plans and specifications will be in the form of an addendum. All Addenda will be posted online within the project folder at the following website:

https://www.phoenix.gov/streets/procurement/current-opportunities

A Planholder List is available within the project folder on the Water Services Department website under “Current Opportunities”. The web address is:

https://www.phoenix.gov/streets/procurement/current-opportunities

For additional information prior to submitting your bid, contact:

Plans, Technical/Special Provisions, Proposal or Specifications:
NAME: Debra Russell, Contract Procurement Section
ADDRESS: 200 W. Washington Street, 6th Floor, Phoenix, AZ 85003-1611
PHONE: (602) 256-3444 E-MAIL: Debra.Russell@phoenix.gov

SBE Utilization contact:
Equal Opportunity Department: (602) 262-6790

All questions regarding the plans and specifications must be received (in writing) at a minimum 7 calendar days prior to bid opening. Questions received after that time may not be given any consideration.

B. **REQUEST FOR SUBSTITUTIONS**

Paragraph A, B, and C of MAG Section 106.4 are deleted and the following paragraphs substituted:

1. The Engineer will consider written request(s), by a prime bidder only, for substitution(s) which is/are considered equivalent to the item(s) specified in the Contract documents. The written request will be considered only if it is received at least twelve (12) calendar days prior to the established bid date. Notification of acceptable substitutions will be made by addendum issued no fewer than 7 calendar days prior to the established bid date. (A.R.S. 34-104)

2. The prime bidder, at his own expense, will furnish the necessary data of substitution and validate that the physical, chemical, and operational qualities of each substitute item is such that this item will fulfill the originally specified required function.

3. The substitution, if approved, will be authorized by a written addendum to the Contract documents and will be made available to all bidders. The bid date and the scheduled completion time will not be affected by any circumstances developing from this substitution.

4. The request will be submitted to the Design and Construction Procurement Section,
C. **BID BOND**

Bidders must submit a properly completed proposal guarantee, certified check, cashier's check or on the surety bond provided, for an amount not less than ten (10) percent of the total amount bid included in the proposal as a guarantee that the contractor will enter into a contract to perform the proposal in accordance with the plans and specifications. Surety bonds submitted for this project will be provided by a company which has been rated "A- or better for the prior four quarters" by the A.M. Best Company. **A bid will be deemed non-responsive if not accompanied by this guarantee.**

The surety bond will be executed solely by a surety company or companies holding a certificate of authority to transact surety business in the State of Arizona, issued by the Director of the Department of Insurance pursuant to Title 20, Chapter 2, Article 1. The surety bond will not be executed by an individual surety or sureties even if the requirements of Section 7-101 are satisfied. The City Clerk will return the certified check, cashiers check, or surety bond to the contractors whose proposals are not accepted, and to the successful contractor upon the execution of a satisfactory bond and contract.

When providing a Surety Bond, **failure to provide an "A- or better for the prior four quarters" bond will result in bid rejection.**

D. **LIST OF MAJOR SUBCONTRACTORS AND SUPPLIERS & LIST OF ALL SUBCONTRACTORS AND SUPPLIERS**

**A bid will be deemed non-responsive if not accompanied by a properly completed and signed “List of Major Subcontractors and Suppliers” form.**

To assist in eliminating the practice of bid shopping on City construction projects, the bidder will list all Major Subcontractors and Suppliers (including SBE) to whom the bidder intends to contract with that are equal to or greater than 5% of the base bid. The list of major subcontractors and suppliers will be provided on the “List of Major Subcontractors” form. **Failure to properly complete and sign this form will result in bid rejection.** This form is due with the bid.

If substantial evidence exists that bid shopping occurred on this project, the Bidder will be ineligible to bid on City construction projects for a period of one year.

The list of All Subcontractors and Suppliers will be provided on the “List of All Subcontractors and Suppliers” form. **Failure to properly complete and sign this form will result in bid rejection.** This form is due 3 days after bid opening by 5:00 p.m. A bid will be deemed non-responsive if a properly completed and signed “List of All Subcontractors and Suppliers” form is not submitted.

E. **BID SUBMITTAL**

The properly completed bid documents along with the ten (10) percent bid guarantee will be submitted in a sealed envelope. The outside of the envelope will be marked as follows:

Bid of (Firm's Name, Address and Phone Number)________________________
For: 91st Avenue WWTP Sludge Solar Drying Beds
City of Phoenix Project Number: WS90100098-1

Sealed bids will be submitted to the bid box located by the Street Transportation Department
Reception Desk located on the Sixth Floor of the Phoenix City Hall Building, 200 W. Washington Street, Phoenix, Arizona, 85003 prior to the time and date specified for bid opening.

F. **BID WITHDRAWALS**

MAG Section 102-10, Withdrawal or Revision of Proposal, is hereby deleted and the following paragraph is submitted:

"No bidder may withdraw or revise a proposal after it has been deposited with the City except as provided in Phoenix City Code Chapter 2, Section 190.2. Proposals, read or unread, will not be returned to the bidders until after determination of award has been made.

G. **ADDENDA**

*Acknowledge all addenda; a bid will be deemed non-responsive if all issued addenda for this project are not acknowledged in writing on Page P-1.*

The City of Phoenix will not be responsible for any oral responses or instructions made by any employees or officers of the City of Phoenix regarding bidding instructions, plans, drawings, specifications or contract documents. A verbal reply to an inquiry does not constitute a modification of the Invitation for Bid (IFB). Any changes to the plans, drawings and specifications will be in the form of an addendum.

It will be the responsibility of the prospective bidder to determine, prior to the submittal of its bid, if any addenda to the project have been issued by the Water Services Department Contract Procurement Section. All addenda issued will be acknowledged by the bidder on Page P-1. All addenda (if any) will be available online within each project's folder at the following website:

[https://www.phoenix.gov/streets/procurement/current-opportunities](https://www.phoenix.gov/streets/procurement/current-opportunities)

The contractors and/or consultants are responsible for ensuring they have all addenda and/or notifications for all projects they are submitting on. Prospective bidders are strongly encouraged to check the Water Services Department Contract Procurement website in order to ascertain if any addenda have been issued for the project.

H. **BID SUBMITTAL CHECKLIST**

This checklist is provided to remind bidders of several of the required elements of the bid packages. It is not intended to be a comprehensive list of all of the contract documents. Bidders are encouraged to review all of the Bid Instructions to determine compliance therein.

**ALL FIRMS MUST BE REGISTERED IN THE CITY’S VENDOR MANAGEMENT SYSTEM PRIOR TO SUBMITTING A PROPOSAL. FOR NEW FIRMS - THE CITY WILL SEND AN EMAIL TO YOUR FIRM WITH A VENDOR NUMBER WITHIN TWO DAYS OF SUBMITTING THE REQUEST. THE VENDOR NUMBER NEEDS TO BE INCLUDED ON THE COVER OF THE STATEMENT OF QUALIFICATIONS OR ON THE BID PROPOSAL PACKAGE/ENVELOPE. INFORMATION ON HOW TO REGISTER WITH THE CITY IS AVAILABLE AT:**

[https://www.phoenix.gov/finance/vendorsreg](https://www.phoenix.gov/finance/vendorsreg)

- Acknowledge all addenda? (Page P-1)
Completed all of the Bid Proposal forms? (Pages P-1 to P-5 and P.S.-1)

Included your Bid Bond (rated A- or better for the prior four quarters) or Guarantee Cashier’s Check? (Page S.B.-1)

Completed SBE Utilization form or a fully documented waiver package? (Page S.B.U.-1)

Completed List of Major Subcontractors and Suppliers form? (Page L.O.S.-1)

Completed Letter of Intent to Perform as Subcontractor/Supplier (L.O.I.-1)

PLEASE DO NOT SUBMIT THE ENTIRE SPECIFICATION BOOK WHEN SUBMITTING YOUR BID. INCLUDE ONLY THE REQUIRED BIDDING DOCUMENTS.

POST-BID SUBMITTAL CHECKLIST

All bidders wishing to remain in contention for award of the contract must submit completed contracts documents listed below. The documents must be submitted to the Design and Construction Procurement Section, 6th Floor, Phoenix City Hall, 200 W. Washington Street, Phoenix, Arizona 85003-1611 or can be sent by email to: Debra.Russell@phoenix.gov.

Completed List of All Subcontractors and Suppliers form (L.O.S.-2) (3 days after bid opening by 5:00 p.m.)

Bidders Disclosure Statement? (Pages B.D.S.-1 to 4) (3 days after bid opening by 5:00 p.m.)

Submit Affidavit of Identity (if you are a sole proprietor) (Page A.O.I. – 1) (3 days after bid opening by 5:00 p.m.)

I. CANCELLATION OF CONTRACT FOR CONFLICT OF INTEREST

All parties hereto acknowledge that this Agreement is subject to cancellation by the City of Phoenix pursuant to the provisions of Section 38-511, Arizona Revised Statutes.

J. CONTRACTOR’S LICENSE AND PRIVILEGE LICENSE AND CERTIFICATIONS

Prior to bidding on this project, the bidder must possess the correct license to perform the work described in the plans and specifications. Prior to award of the contract, the successful bidder must provide to the Contract Procurement Section its Contractor’s License Classification and number, its City of Phoenix Privilege License number and Federal Tax Identification number.

Bidder will submit the Bidder’s Disclosure Statement as set forth in Pages B.D.S. - 1 to B.D.S. - 4 within 3 days of bid opening by 5:00 p.m.

Unless provided otherwise in this solicitation, Bidder will be deemed non-responsive and the bid rejected if Bidder fails to possess the proper Contractor’s and Business Licenses at the time of bid or fails to submit a substantially completed Bidder’s Disclosure Statement as specified above.

K. TAX LIABILITIES; DISCLOSURE OF CONVICTIONS AND BREACH(S) OF CONTRACT

On or before the award of the contract for this project, the successful bidder will: (i) file all applicable tax returns and will make payment for all applicable State of Arizona and Maricopa
County Transaction Taxes (ARS Sec. 41-1305) and City of Phoenix Privilege License Taxes (Phoenix City Code Sec.14-415); (ii) disclose any civil fines, penalties or any criminal convictions, other than for traffic related offenses, for violation of federal, state, county or city laws, rules or regulations including, but not limited to, environmental, OSHA, or labor compliance laws (collectively “Laws”) by Bidder, Bidder’s directors, managing members, responsible corporate officers or party who will be responsible for overseeing and administering this project (collectively “Bidder”); and (iii) disclose any material breach(s) of an agreement with the City of Phoenix, any termination for cause or any litigation involving the City of Phoenix occurring within the past three calendar years. Unless provided otherwise in this solicitation, the successful bidder will be deemed non-responsible and the bid rejected for any of the following: (i) Bidder’s civil or criminal conviction, other than for traffic related offenses, for a violation of Laws within the past three calendar years; (ii) liability or culpability resulting in payment of fines or penalties in the cumulative total amount of $100,000 or greater for a violation of “Laws” within the past three calendar years; (iii) material breach of a City of Phoenix agreement, termination for cause or litigation with the City of Phoenix within the past three calendar years; and (iv) Bidder’s failure to disclose the information as required by this provision. Further, after award of contract, in addition to any other remedy, Bidder’s failure to remit proper taxes to the City of Phoenix may result in the City withholding payment pursuant to Phoenix City Charter Chapter XVIII, Section 14 until all delinquent taxes, interest, and penalties have been paid.

State and Local Transaction Privilege Taxes:

In accordance with applicable state and local law, transaction privilege taxes may be applicable to this transaction. The state and local transaction privilege (sales) tax burden is on the person who is conducting business in Arizona and the City of Phoenix. The legal liability to remit the tax is on the person conducting business in Arizona. Any failure by the Contractor to collect applicable taxes from the City will not relieve the Contractor from its obligation to remit taxes.

It is the responsibility of the prospective bidder to determine any applicable taxes. The City will look at the price or offer submitted and will not deduct, add or alter pricing based on speculation or application of any taxes, nor will the City provide advice or guidance.

If you have questions regarding your tax liability, please seek advice from a tax professional prior to submitting your bid. You may also find information at https://www.phoenix.gov/finance/plt or https://www.azdor.gov/Business.aspx. Once your bid is submitted, the Offer is valid for the time specified in this Solicitation, regardless of mistake or omission of tax liability.

If the City finds over payment of a project due to tax consideration that was not due, the Contractor will be liable to the City for that amount, and by contracting with the City agrees to remit any overpayments back to the City for miscalculations on taxes included in a bid price.

Tax Indemnification:
Contractor will, and require the same of all subcontractors, pay all federal, state and local taxes applicable to its operation and any persons employed by the Contractor. Contractor will, and require the same of all subcontractors, hold the City harmless from any responsibility for taxes, damages and interest, if applicable, contributions required under federal, and/or state and local laws and regulations and any other costs including transaction privilege taxes, unemployment compensation insurance, Social Security and Worker’s Compensation.

Tax Responsibility Qualification:
Contractor may be required to establish, to the satisfaction of City, that any and all fees and taxes due to the City or the State of Arizona for any License or Transaction Privilege taxes, Use Taxes or similar excise taxes, are currently paid (except for matters under legal protest).
Contractor agrees to a waiver of the confidentiality provisions contained in the City Finance Code and any similar confidentiality provisions contained in Arizona statutes relative to State Transaction Privilege Taxes or Use Taxes.

Contractor agrees to provide written authorization to the City Finance Department and to the Arizona State Department of Revenue to release tax information relative to Arizona Transaction Privilege Taxes or Arizona Use Taxes in order to assist the Department in evaluating Contractor’s qualifications for and compliance with contract for duration of the term of contract.

L. **STANDARD SPECIFICATIONS AND DETAILS**

Except as otherwise required in these specifications, bid preparation and construction of this project will be in accordance with all applicable Maricopa Association of Governments' (MAG) Uniform Standard Specifications and Uniform Standard Details, latest revision, and the City of Phoenix Supplements to the MAG Uniform Standard Specifications and Details, latest revision.

M. **PRECEDENCE OF CONTRACT DOCUMENTS**

In case of a discrepancy or conflict, the precedence of contract documents is as follows:

1. Change Orders or Supplemental Agreements
2. Addenda
4. The Plans
5. COP Supplement to MAG Standard Specifications and Details, latest revision
6. MAG Standard Specifications and Details, latest revision

The precedence of any Addenda falls within the category of which it represents.

N. **CONFIDENTIALITY OF PLANS & SPECIFICATIONS**

Any plans generated for this project must include the following statement in the Title Block on every page: “Per City of Phoenix City Code Chapter 2, Section 2-28, these plans are for official use only and may not be shared with others except as required to fulfill the obligations of Contractor’s contract with the City of Phoenix.”

O. **AUDIT AND RECORDS**

Records of the Contractor's direct personnel payroll, bond expenses, and reimbursable expenses pertaining to this Project, and records of accounts between the City and Contractor will be kept on the basis of generally accepted accounting principles and must be made available to the City and its auditors for up to three years following Final Acceptance of the Project.

The City, its authorized representative, and/or any federal agency, reserves the right to audit the Contractor's records to verify the accuracy and appropriateness of all cost and pricing data, including data used to negotiate the Contract and any change orders.

The City reserves the right to decrease Contract price and/or payments made on this Contract and/or request reimbursement from the Contractor following final contract payment on this Contract if, upon audit of the Contractor's records, the audit discloses the Contractor has provided false, misleading, or inaccurate cost and pricing data.
The Contractor will include a similar provision in all of its Agreements with subcontractors and suppliers providing services or supplying materials under the Contract Documents to ensure that the City, its authorized representative, and/or the appropriate federal agency has access to the Subcontractor's and Supplier's records to verify the accuracy of all cost and pricing data.

The City reserves the right to decrease the Contract price and/or payments made on this Contract and/or request reimbursement from the Contractor following final contract payment on this Contract if the above provision is not included in the Subcontractor's and Supplier's contracts, and one or more Subcontractors or Suppliers refuse to allow the City to audit their records to verify the accuracy of all cost and pricing data.

If, following an audit of this Contract, the audit discloses the Contractor has provided false, misleading or inaccurate cost and pricing data, and the cost discrepancies exceed 1% of the total Contract billings, the Contractor will be liable for reimbursement of the reasonable, actual cost of the audit.

P. IMMIGRATION REFORM AND CONTROL ACT

Compliance with Federal Laws Required. Contractor understands and acknowledges the applicability of the Immigration Reform and Control Act of 1986 and the Drug Free Workplace Act to it. Contractor agrees to comply with these Federal Laws in performing under this Agreement and to permit City inspection of its personnel records to verify such compliance.

Q. LEGAL WORKER REQUIREMENTS

The City of Phoenix is prohibited by A.R.S. § 41-4401 from awarding a contract to any contractor who fails, or whose subcontractors fail, to comply with A.R.S. § 23-214(A). Therefore, Contractor agrees that:

1. Contractor and each subcontractor it uses warrants their compliance with all federal immigration laws and regulations that relate to their employees and their compliance with § 23-214, subsection A.

2. A breach of a warranty under paragraph 1 will be deemed a material breach of the contract that is subject to penalties up to and including termination of the contract.

3. The City of Phoenix retains the legal right to inspect the papers of any Contractor or subcontractor employee who works on the contract to ensure that the Contractor or subcontractor is complying with the warranty under paragraph 1.

R. CONTRACTOR AND SUBCONTRACTOR WORKER BACKGROUND SCREENING

Background Screening Requirements and Criteria

The City has established levels of risk and associated Background Screening. For Contractor services in the right-of-way, the risk level and Background Screening required is Minimum Risk. The risk level and background screening required for this project is Standard.

Terms of This Section Applicable to all of Contractor's Contracts and Subcontracts

Contractor will include the terms of this Section for Contract Worker Background Screening in all contracts and subcontracts for services furnished under this Agreement including, but not limited to, supervision and oversight services.

(1.) Contract Worker Background Screening
Contractor agrees that all contract workers and subcontractors (collectively “Contract Worker(s)”) that Contractor furnishes to the City pursuant to this Agreement will be subject to background and security checks and screening (collectively “Background Screening”) at Contractor’s sole cost and expense as set forth in this Section. The Background Screening provided by Contractor will comply with all applicable laws, rules and regulations. Contractor further agrees that the Background Screening required in this Section is necessary to preserve and protect public health, safety and welfare. The Background Screening requirements set forth in this Section are the minimum requirements for this Agreement. The City in no way warrants that these minimum requirements are sufficient to protect Contractor from any liabilities that may arise out of Contractor’s services under this Agreement or Contractor’s failure to comply with this Section. Therefore, in addition to the specific measures set forth below, Contractor and its Contract Workers will take such other reasonable, prudent and necessary measures to further preserve and protect public health, safety and welfare when providing services under this Agreement. The City may, in its sole discretion, accept or reject any or all of the Contract Workers proposed by Contractor to perform work under this Agreement, as well those Contract Workers actually providing services during the term of this Agreement.

Standard Risk and Background Screening requirements include the following:

A Standard Risk Background Screening will be performed when the Contract Worker’s work assignment will: (i) require a badge or key for access to City facilities; or (ii) allow any access to sensitive, confidential records, personal identifying information or restricted City information; or (iii) allow unescorted access to City facilities during normal and non-business hours. The Background Screening for this standard risk level will include the Background Screening required for the Minimum Risk level and a background check for real identity/legal name, and will include felony and misdemeanor records from any county in the United States, the state of Arizona, plus any other jurisdiction where the Contract Worker has lived at any time in the preceding seven (7) years from the Contract Worker’s proposed date of hire.

(2.) Materiality of Background Screening Requirements; Indemnity
The Background Screening requirements of this Section are material to City’s entry into this Agreement and any breach of this Section by Contractor will be deemed a material breach of this Agreement. In addition to the indemnity provisions set forth in Supplementary Conditions Section 7.G of this Agreement, Contractor will defend, indemnify and hold harmless the City for any and all Claims (as defined in Supplementary Conditions Section 7.G arising out of this Background Screening Section including, but not limited to, the disqualification of a Contract Worker by Contractor or the City for failure to satisfy this Section.

(3.) Continuing Duty; Audit
Contractor’s obligations and requirements that Contract Workers satisfy this Background Screening Section will continue throughout the entire term of this Agreement. Contractor will notify the City immediately of any change to a Maximum Risk Background Screening of a Contract Worker previously approved by the City. Contractor will maintain all records and documents related to all Background Screenings and the City reserves the right to audit Contractor’s compliance with this Section pursuant to Information for Bidders Section 1.M.

S. CONTRACT WORKER ACCESS CONTROLS, BADGE AND KEY ACCESS REQUIREMENTS

(1). A CONTRACT WORKER WILL NOT BE ALLOWED TO BEGIN WORK IN ANY CITY FACILITY WITHOUT: (1) THE PRIOR COMPLETION AND CITY’S ACCEPTANCE OF
THE REQUIRED BACKGROUND SCREENING; AND (2) WHEN REQUIRED, THE CONTRACT WORKER’S RECEIPT OF A CITY ISSUED BADGE. A BADGE WILL BE ISSUED TO A CONTRACT WORKER SOLELY FOR ACCESS TO THE CITY FACILITY(S) TO WHICH THE CONTRACT WORKER IS ASSIGNED. EACH CONTRACT WORKER WHO ENTERS A CITY FACILITY MUST USE THE BADGE ISSUED TO THE CONTRACT WORKER.

(2.) Key Access Procedures
If the Contract Worker’s services require keyed access to enter a City facility(s), a separate key issue/return form must be completed and submitted by the Contractor for each key issued. The key issue/return form is available at and the completed form will be submitted to the badging office at the address above.

(3.) Stolen or Lost Badges or Keys
Contractor will report lost or stolen badges or keys to their local police department and must obtain a police department report (PDR) prior to re-issuance of any lost or stolen badge or key. A new badge application or key issue form will be completed and submitted along with payment of the applicable fees listed below prior to issuance of a new badge or key.

(4.) Return of Badges or Keys
All badges and keys are the property of the City and must be returned to the City at the badging office within one (1) business day of when the Contract Worker’s access to a City facility is no longer required to furnish the services under this Agreement. Contractor will collect a Contract Worker’s badge and key(s) upon the termination of the Contract Worker’s employment; when the Contract Worker’s services are no longer required at the particular City facility(s); or upon termination, cancellation or expiration of this Agreement.

(6.) Contractor’s Default; Liquidated Damages; Reservation of Remedies for Material Breach
Contractor’s default under this Section will include, but is not limited to the following: (i) Contract Worker gains access to a City facility(s) without the proper badge or key; (ii) Contract Worker uses a badge or key of another to gain access to a City facility; (iii) Contract Worker commences services under this Agreement without the proper badge, key or Background Screening; (iv) Contract Worker or Contractor submits false information or negligently submits wrong information to the City to obtain a badge, key or applicable Background Screening; or (v) Contractor fails to collect and timely return Contract Worker’s badge or key upon termination of Contract Worker’s employment, reassignment of Contract Worker to another City facility or upon the expiration, cancellation or termination of this Agreement. Contractor acknowledges and agrees that the access control, badge and key requirements in this Section are necessary to preserve and protect public health, safety and welfare. Accordingly, Contractor agrees to properly cure any default under this Section within three (3) business days from the date notice of default is sent by the City. The parties agree that Contractor’s failure to properly cure any default under this Section will constitute a breach of this Section. In addition to any other remedy available to the City at law or in equity, the Contractor will be liable for and will pay to the City the sum of one thousand dollars ($1,000.00) for each breach by Contractor of this Section. The parties further agree that the sum fixed above is reasonable and approximates the actual or anticipated loss to the City at the time and making of this Agreement in the event that Contractor breaches this Section. Further, the parties expressly acknowledge and agree to the fixed sum set forth above because of the difficulty of proving the City’s actual damages in the event that Contractor breaches this Section. The parties further agree that three (3) breaches by Contractor of this Section arising out of any default within a consecutive period of three (3) months or three (3) breaches by Contractor of this Section arising out of the same default within a period of twelve (12) consecutive months will constitute a material breach of this Agreement by Contractor and the City expressly reserves all of its rights, remedies and interests under
this Agreement, at law and in equity including, but not limited to, termination of this Agreement.

(7.) Badge and Key Fees
The badge and key fee under this Agreement will be $55.00 whether for initial badge/key or replacements. The City reserves the right to amend these fees upon thirty (30) days prior written notice to Contractor.

T. LAWFUL PRESENCE REQUIREMENT
Pursuant to A.R.S. §§ 1-501 and 1-502, the City of Phoenix is prohibited from awarding a contract to any natural person who cannot establish that such person is lawfully present in the United States. To establish lawful presence, a person must produce qualifying identification and sign a City-provided affidavit affirming that the identification provided is genuine. This requirement will be imposed at the time of contract award. This requirement does not apply to business organizations such as corporations, partnerships or limited liability companies.

U. LEADERSHIP IN ENERGY AND ENVIRONMENTAL DESIGN (LEED)
If practical, the contractor will provide an easily accessible area to serve the construction site that is dedicated to the separation, collection and storage of materials for recycling including (at a minimum) paper, glass, plastics, metals, and designate an area specifically for construction and demolition waste recycling. The contractor must provide documentation that the materials have been taken to a Maricopa County approved recycling facility.

V. NO ISRAEL BOYCOTT
By entering into this contract, the Engineer/Contractor certifies that they are not currently engaged in, and agrees for the duration of the Contract to not engage in, a boycott of Israel.

W. CITY OF PHOENIX EQUAL EMPLOYMENT OPPORTUNITY REQUIREMENT
1. In order to do business with the City, Contractor must comply with Phoenix City Code, 1969, Chapter 18, Article V, as amended, Equal Employment Opportunity Requirements. Contractor will direct any questions in regard to these requirements to the Equal Opportunity Department, (602) 262-6790.

2. Any Contractor in performing under this contract will not discriminate against any worker, employee or applicant, or any member of the public, because of race, color, religion, sex, national origin, age, or disability nor otherwise commit an unfair employment practice. The Contractor will ensure that applicants are employed, and employees are dealt with during employment without regard to their race, color, religion, sex, national origin, age, or disability and will adhere to a policy to pay equal compensation to men and women who perform jobs that require substantially equal skill, effort, and responsibility, and that are performed within the same establishment under similar working conditions. Such action will include but not be limited to the following: Employment, promotion, 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 further agrees that this clause will be incorporated in all subcontracts with all labor organizations furnishing skilled, unskilled and union labor, or who may perform any such labor or services in connection with this contract.

If the Contractor employs more than thirty-five employees, the following language will apply as the last paragraph to the clause above:

The Contractor further agrees not to discriminate against any worker, employee or
applicant, or any member of the public, because of sexual orientation or gender identity or expression and will ensure that applicants are employed, and employees are dealt with during employment without regard to their sexual orientation or gender identity or expression.

3. **Documentation.** Contractor may be required to provide additional documentation to the Equal Opportunity Department affirming that a nondiscriminatory policy is being utilized.

4. **Monitoring.** The Equal Opportunity Department will monitor the employment policies and practices of suppliers and lessees subject to this article as deemed necessary. The Equal Opportunity Department is authorized to conduct on-site compliance reviews of selected firms, which may include an audit of personnel and payroll records, if necessary.

X. **PROTEST PROCEDURES**

A bidder wishing to file a protest for the subject project will comply with Phoenix City Code Chapter 2, Section 188.

Y. **DATA CONFIDENTIALITY**

As used in the Contract, “data” means all information, whether written or verbal, including plans, photographs, studies, investigations, audits, analyses, samples, reports, calculations, internal memos, meeting minutes, data field notes, work product, proposals, correspondence and any other similar documents or information prepared by, obtained by, or transmitted to the Contractor or its subcontractors in the performance of this Contract.

The parties agree that all data, regardless of form, including originals, images, and reproductions, prepared by, obtained by, or transmitted to the Contractor or its subcontractors in connection with the Contractor’s or its subcontractor’s performance of this Contract is confidential and proprietary information belonging to the City.

Except as specifically provided in this Contract, the Contractor or its subcontractors will not divulge data to any third party without prior written consent of the City. The Contractor or its subcontractors will not use the data for any purposes except to perform the services required under this Contract. These prohibitions will not apply to the following data provided the Contractor or its subcontractors have first given the required notice to the City:

A. Data which was known to the Contractor or its subcontractors prior to its performance under this Contract unless such data was acquired in connection with work performed for the City;

B. Data which was acquired by the Contractor or its subcontractors in its performance under this Contract and which was disclosed to the Contractor or its subcontractors by a third party, who to the best of the Contractor’s or its subcontractor’s knowledge and belief, had the legal right to make such disclosure and the Contractor or its subcontractors are not otherwise required to hold such data in confidence; or

C. Data which is required to be disclosed by virtue of law, regulation, or court order, to which the Contractor or its subcontractor’s are subject.

In the event the Contractor or its subcontractors are required or requested to disclose data to a third party, or any other information to which the Contractor or its subcontractors became privy as a result of any other contract with the City, the Contractor will first notify the City as set forth in this section of the request or demand for the data. The Contractor or its subcontractors will give the City sufficient facts so that the City can be given an opportunity to first give its consent or take such action that the City may deem appropriate to protect such data or other information from disclosure.
The Contractor, unless prohibited by law, within ten calendar days after completion of services for a third party on real or personal property owned or leased by the City, the Contractor or its subcontractors will promptly deliver, as set forth in this section, a copy of all data to the City. All data will continue to be subject to the confidentiality agreements of this Contract.

The Contractor or its subcontractors assume all liability for maintaining the confidentiality of the data in its possession and agrees to compensate the City if any of the provisions of this section are violated by the Contractor, its employees, agents or subcontractors. Solely for the purposes of seeking injunctive relief, it is agreed that a breach of this section will be deemed to cause irreparable harm that justifies injunctive relief in court. Contractor agrees that the requirements of this Section will be incorporated into all subcontracts entered into by Contractor. A violation of this Section may result in immediate termination of this Contract without notice.

Personal Identifying Information-Data Security

Personal identifying information, financial account information, or restricted City information, whether electronic format or hard copy, must be secured and protected at all times. At a minimum, Contractor must encrypt and/or password protects electronic files. This includes data saved to laptop computers, computerized devices or removable storage devices.

When personal identifying information, financial account information, or restricted City information, regardless of its format, is no longer necessary, the information must be redacted or destroyed through appropriate and secure methods that ensure the information cannot be viewed, accessed, or reconstructed.

In the event that data collected or obtained by Contractor or its subcontractors in connection with this Contract is believed to have been compromised, Contractor or its subcontractors will immediately notify the Project Manager and City Engineer. Contractor agrees to reimburse the City for any costs incurred by the City to investigate potential breaches of this data and, where applicable, the cost of notifying individuals who may be impacted by the breach.

Contractor agrees that the requirements of this Section will be incorporated into all subcontracts entered into by Contractor. It is further agreed that a violation of this Section will be deemed to cause irreparable harm that justifies injunctive relief in court. A violation of this Section may result in immediate termination of this Contract without notice.

The obligations of Contractor or its subcontractors under this Section will survive the termination of this Contract.
Below is a listing of possible trade areas for this project. These were the trade areas identified in the goal setting process. However, the contractor may identify additional trade areas to be used.

- Site Preparation / Earthwork / Excavation
- Asphalt Paving
- Demolition / Wrecking
- Manholes
- Concrete
- Pipeline / Underground Utilities
- Hauling
- Metal: Steel / Aluminum
- Fabrication / Erection
- Electrical
- Site Clearing & Grubbing

Only SBE subcontractors certified by the City of Phoenix under Chapter 18, Article VII of the Phoenix City Code are eligible to fulfill the participation goal as stated. A firm’s certification must be current and in force at the date and time of the bid. The most current electronic listing of all Certified SBE firms can be accessed through the Internet at:

https://phoenix.diversitycompliance.com

SBE: 2%
SUPPLEMENTARY CONDITIONS

1. **103 AWARD AND EXECUTION OF CONTRACT.** Add the following to Subsection 103.3 AWARD OF CONTRACT:

   Contract award will be made to a responsive and responsible bidder based on the low total base bid or on the low combination of the total base bid and any selected alternate(s), whichever is in the best interest of the City. If unit pricing is required in the proposal, the extensions and additions will be verified to assure correctness. Award will be based on the revised total if any errors are found. Additionally, the Contractor will meet the minimum SBE subcontracting goal set for this contract or have been granted a full or partial waiver of the goal. The City expressly reserves the right to cancel this agreement without recourse or prejudice to Contractor until all parties have executed the agreement in full.

   Any bidder that currently contracts with the City must be in good standing for its proposal to be considered responsive. For the purpose of this Invitation to Bid, good standing means compliance with all contractual provisions, including payment of financial obligations.

2. **103 AWARD AND EXECUTION OF CONTRACT.** Add the following to Subsection 103.5, REQUIREMENT OF CONTRACT BONDS:

   **A. PERFORMANCE BOND AND LABOR AND MATERIAL BOND**

   Prior to the execution of a contract, the successful bidder must provide a performance bond and a labor and material bond, each in an amount equal to the full amount of the contract. Each such bond will be executed by a surety company or companies holding a certificate of authority to transact surety business in the State of Arizona issued by the Director of the Department of Insurance. A copy of the Certificate of Authority will accompany the bonds. The Certificate will have been issued or updated within two years prior to the execution of the Contract. The bonds will be made payable and acceptable to the City of Phoenix. The bonds will be written or countersigned by an authorized representative of the surety who is either a resident of the State of Arizona or whose principal office is maintained in this state, as required by law, and the bonds will have attached thereto a certified copy of Power of Attorney of the signing official. If one Power of Attorney is submitted, it will be for twice the total contract amount. If two Powers of Attorney are submitted, each will be for the total contract amount. Personal or individual bonds are not acceptable. Failure to comply with these provisions will be cause for rejection of the bidder's proposal.

   **B. BONDING COMPANIES**

   All bonds submitted for this project will be provided by a company which has been rated “A- or better for the prior four quarters” by the A. M. Best Company. Failure to provide an "A- or better for the prior four quarters” bond will result in bid rejection.

3. **103 AWARD AND EXECUTION OF CONTRACT.** Delete Subsection 103.6, CONTRACTOR’S INSURANCE in its entirety and substitute the following:

   **103.6.1 General:**

   Contractor and subcontractors must procure insurance against claims that may arise from or relate to performance of the work hereunder by Contractor and its agents, representatives, employees and subconsultants. Contractor and subcontractors must maintain that insurance until all of their obligations have
been discharged, including any warranty periods under this Contract.

These insurance requirements are minimum requirements for this Contract and in no way limit the indemnity covenants contained in this Contract.

The City in no way warrants that the minimum limits stated in this section are sufficient to protect the Contractor from liabilities that might arise out of the performance of the work under this Contract by the Contractor, its agents, representatives, employees, or subcontractors. Contractor is free to purchase such additional insurance as may be determined necessary.

A. MINIMUM SCOPE AND LIMITS OF INSURANCE

Contractor must provide coverage with limits of liability not less than those stated below. An excess liability policy or umbrella liability policy may be used to meet the minimum liability requirements provided that the coverage is written on a "following form" basis:

1. Commercial General Liability – Occurrence Form
   Policy must include bodily injury, property damage, broad form contractual liability and XCU coverage.
   
   General Aggregate/for this Project: $2,000,000/1,000,000
   Products – Completed Operations Aggregate: $1,000,000
   Personal and Advertising Injury: $1,000,000
   Each Occurrence: $1,000,000
   a. The policy must be endorsed to include the following additional insured language: "The City of Phoenix is named as an additional insured with respect to liability arising out of the activities performed by, or on behalf of the Contractor, including completed operations”.

2. Automobile Liability
   Bodily injury and property damage coverage for any owned, hired, and non-owned vehicles used in the performance of this Contract.
   
   Combined Single Limit (CSL): $1,000,000
   a. The policy must be endorsed to include the following additional insured language: "The City of Phoenix is named as an additional insured with respect to liability arising out of the activities performed by, or on behalf of the Contractor, including automobiles owned, leased, hired or borrowed by the Contractor”.

3. Worker’s Compensation and Employers’ Liability
   
   Workers’ Compensation: Statutory
   Employers’ Liability
   Each Accident: $100,000
   Disease – Each Employee: $100,000
   Disease – Policy Limit: $500,000
a. Policy must contain a waiver of subrogation against the City of Phoenix.

b. This requirement does not apply when a contractor or subcontractor is exempt under A.R.S. §23-902(E), AND when such contractor or subcontractor executes the appropriate sole proprietor waiver form.

4. **Builders’ Risk Insurance or Installation Floater**

   In an amount equal to the initial Contract Amount plus additional coverage equal to Contract Amount for all subsequent change orders.

   a. The City of Phoenix, the Contractor and subcontractors, must be Insureds on the policy.

   b. Coverage must be written on an all risk, replacement cost basis and must include coverage for soft costs, flood and earth movement.

   c. Policy must be maintained until whichever of the following must first occur: (1) final payment has been made; or, (2) until no person or entity, other than the City of Phoenix, has an insurable interest in the property required to be covered.

   d. Policy must be endorsed such that the insurance must not be canceled or lapse because of any partial use or occupancy by the City.

   e. Policy must provide coverage from the time any covered property becomes the responsibility of the Contractor, and continue without interruption during construction, renovation, or installation, including any time during which the covered property is being transported to the construction installation site, or awaiting installation, whether on or off site.

   f. Policy must contain a waiver of subrogation against the City of Phoenix.

   g. Contractor is responsible for the payment of all policy deductibles.

B. **ADDITIONAL INSURANCE REQUIREMENTS**

The policies must include, or be endorsed to include, the following provisions:

1. On insurance policies where the City of Phoenix is named as an additional insured, the City of Phoenix is an additional insured to the full limits of liability purchased by the Contractor even if those limits of liability are in excess of those required by this Contract.

2. The Contractor’s insurance coverage must be primary insurance and non-contributory with respect to all other available sources.

3. With regard to general liability, the City of Phoenix is named as an additional insured for both products completed operations and premises operations.

C. **NOTICE OF CANCELATION**

For each insurance policy required by the insurance provisions of this Contract, the Contractor must provide to the City, within 2 business days of receipt, a notice if a policy is suspended, voided or
cancelled for any reason. Such notice will be sent directly to the City of Phoenix Contract Specialist listed on Page I.B.-1 of these specifications and will be sent by certified mail, return receipt requested.

D. ACCEPTABILITY OF INSURERS

Insurance is to be placed with insurers duly licensed or authorized to do business in the state of Arizona and with an “A.M. Best” rating of not less than B+ VI. The City in no way warrants that the above-required minimum insurer rating is sufficient to protect the Contractor from potential insurer insolvency.

E. VERIFICATION OF COVERAGE

Contractor must furnish the City with certificates of insurance (ACORD form or equivalent approved by the City) as required by this Contract. The certificates for each insurance policy are to be signed by a person authorized by that insurer to bind coverage on its behalf. Any policy endorsements that restrict or limit coverage will be clearly noted on the certificate of insurance.

All certificates and any required endorsements are to be received and approved by the City before work commences. Each insurance policy required by this Contract must be in effect at or prior to commencement of work under this Contract and remain in effect for the duration of the project. Failure to maintain the insurance policies as required by this Contract or to provide evidence of renewal is a material breach of contract.

All certificates required by this Contract must be sent directly to the City of Phoenix Contract Specialist listed on Page I.B.-1 of these specifications. The City project/contract number and project description must be noted on the certificate of insurance. The City reserves the right to require complete, certified copies of all insurance policies required by this Contract at any time. DO NOT SEND CERTIFICATES OF INSURANCE TO THE CITY’S RISK MANAGEMENT DIVISION.

If the Certificate of Insurance reflecting policy coverage and cancellation notice does not conform to the City’s requirements, the contractor must:

- Submit a current insurance certificate (dated within 15 days of the payment request submittal) with each payment request form. The payment request will be rejected if the insurance certificate is not submitted with the payment request.

F. SUBCONTRACTORS

Contractors’ certificate(s) must include all subcontractors as additional insureds under its policies or subcontractors must maintain separate insurance as determined by the Contractor, however, subcontractor’s limits of liability must not be less than $1,000,000 per occurrence/$2,000,000 aggregate.

G. APPROVAL

Any modification or variation from the insurance requirements in this Contract must be made by the Law Department, whose decision is final. Such action will not require a formal Contract amendment, but may be made by administrative action.

103.6.2 Indemnification of City Against Liability

Contractor agrees to indemnify, defend, save and hold harmless the City of Phoenix and its officers, agents
and employees (and any jurisdiction or agency issuing permits for any work included in the project, and its officers, agents and employees), (“Indemnitee”) from all claims, actions, liabilities, damages, losses or expenses, (including court costs, attorney’s fees and costs of claim processing, investigation and litigation) (“Claims”) caused or alleged to be caused, in whole or in part, by the wrongful, negligent or willful acts, or errors or omissions of Contractor or any of its owners, officers, directors, agents, employees, or subcontractors in connection with this Contract. This indemnity includes any Claim or amount arising out of or recovered under workers’ compensation law or on account of the failure of Contractor to conform to any federal, state or local law, statute, ordinance, rule, regulation, or court decree. Contractor must indemnify Indemnitee from and against any and all Claims, except those arising solely from Indemnitee’s own negligent or willful acts or omissions. Contractor is responsible for the coordination of all work to minimize disruption to building occupants and facilities.

4. **104 SCOPE OF WORK.** Add the following to Subsection 104.1.2 MAINTENANCE OF TRAFFIC:

ADA AND ANSI ACCESS OF PREMISES DURING CONSTRUCTION

Contractor will maintain existing ADA and ANSI accessibility requirements during construction activities in an occupied building or facility. ADA and ANSI accessibility requirements will include, but not be limited to, parking, building access, entrances, exits, restrooms, areas of refuge, and emergency exit paths of travel. Contractor will be responsible for the coordination of all work to minimize disruption to building occupants and facilities.

5. **104 SCOPE OF WORK.** Add the following to Subsection 104.1.4 CLEANUP AND DUST CONTROL:

The Contractor will use a power pick-up broom as part of the dust control effort. No separate measurement or payment will be made for cleanup or dust control, or for providing a power pick-up broom on the job.

6. **105 CONTROL OF WORK.** Add the following to Subsection 105.1, AUTHORITY OF THE ENGINEER:

A. CONTRACT ADMINISTRATION

The definition of "Engineer" will read as follows:

"Engineer": All references to "Engineer" in these contract bid documents, including the MAGSpecifications, will mean City Engineer.

B. PRECONSTRUCTION CONFERENCE

After completion of the contract documents, to include bonds, insurance and signatures and prior to the commencement of any work on the project, the Water Services Department, WWECM Division, (telephone 602-495-2050), will schedule a Pre-Construction Conference.

Construction administration will be provided by City of Phoenix, Water Services Department, Wastewater Engineering & Construction Management.

The purpose of this conference is to establish a working relationship between the Contractor, utility firms and various City agencies. The agenda will include critical elements of the work schedule, submittal schedule, cost breakdown of major lump sum items, payment application and processing, coordination with the involved utility firms, emergency telephone numbers for all representatives
involved in the course of construction and establishment of the notice to proceed date. The Contractor
will also provide copies of all purchase orders and/or contracts with SBE subcontractors and suppliers
used to meet the subcontract goals programmed for this project.

Minimum attendance by the Contractor will be a responsible company/corporate official, who is
authorized to execute and sign documents on behalf of the firm, the job superintendent and the
Contractor's safety officer.

C. AUTHORIZATION OF THE ENGINEER

The City may, at its discretion and without cause, order the Contractor in writing to stop and suspend
work. Immediately after receiving such notice, the Contractor will discontinue advancing the work
specified under this Agreement.

Such suspension will not exceed one hundred and eighty (180) consecutive days during the duration of
the project.

The Contractor may seek an adjustment of the contract price and time, if the cost or time to perform the
work has been adversely impacted by any suspension or stoppage of work by the City.

7. 105 CONTROL OF WORK, Add the following to Subsection 105.2 PLANS AND SHOP DRAWINGS:

The Contractor will submit as many of the required shop drawings and product data submittals at the Pre-
Construction meeting as practical and possible. All shop drawings and product data submittals will be
submitted sufficiently in advance to allow adequate time for City review(s) and approval. The Contractor will
submit early enough to allow enough time for reviews based on the assumption that a submittal may be
marked “Revise and Resubmit” or “Rejected”, requiring the Contractor to modify the submittal and resubmit for
additional review(s) until acceptance.

A separate transmittal will be used for each specific item type, class of material or equipment for which a
submittal is required. Multiple items under one transmittal will only be allowed when the items taken together
constitute a complete manufacturer’s package, or are so functionally related that the entire package should be
reviewed as a whole. The contractor will submit six (6) hard copies of each shop drawing for review. Email or
FAX submittals will not be accepted.

The Contractor will allow up to four (4) weeks for City review for each submittal. Some submittals may be
simple and straightforward and may not require the full four (4) weeks, but other more complex submittals may
take the full four (4) weeks.

8. 105 CONTROL OF WORK, Delete Subsection 105.8 CONSTRUCTION STAKES, LINES AND GRADES
and substitute the following

Description

The work under this section will consist of furnishing all materials, personnel and equipment necessary to
perform all surveying, staking and verification of the accuracy of all points which have been provided by the
Engineer.

Included in this work will be all calculations required for the satisfactory completion of the project in
conformance with the plans and specifications. The work will be done under the direction of a registered
professional surveyor employed by the Contractor.
Measurements of all removals and pay quantity items will be the responsibility of the Engineer.

When utility adjustments are a part of the contract, the Contractor will perform and be responsible for locating, tying and untying all manholes and valves that are discovered during the course of the contract. The Contractor will set all survey points, stakes and references necessary for carrying out all such adjustments.

The Contractor will keep field notes in bound field books. These books will be available for inspection by City personnel at all times and will become the property of the City of Phoenix upon completion of the project.

**Construction Staking Requirements**

Staking will be performed in accordance with the City of Phoenix's Survey Section Standard Requirements for Staking, As-Buils and Quantity Calculations, plus any special addenda provided by the Engineer. The Contractor will provide to the Engineer in writing, for the Engineer's approval, any special procedures that will be used for construction survey staking completion.

After the Contractor has verified the accuracy of the control points established by the City, the Contractor will set all stakes necessary for construction in accordance with the City of Phoenix Survey Section Standard Requirements.

If errors are discovered during the verification process and control points do not agree with the geometrics shown in the plans, the Contractor will promptly notify the Engineer in writing, and explain the problem in detail. The Engineer will advise the Contractor of any corrective actions which may be necessary.

The Contractor will exercise care in the preservation of stakes, references, bench marks and will reset them when they are damaged, lost, displaced or removed.

Any discrepancies in grade, alignment, locations or dimensions detected by the Contractor will be brought to the attention of the Engineer by letter. No changes in the project plans will be allowed without the approval of the Engineer.

The Engineer reserves the right to make inspections and random checks of any portion of the staking and layout procedure. If, in the Engineer's opinion, the work is not being performed in the manner that will assure proper control and accuracy, the Engineer will order any or all of the staking and layout work redone at no additional cost.

If any portion of the Contractor's staking and layout work is ordered redone, resulting in additional rechecking by the Engineer, the City will be reimbursed for all costs for such additional checking. The amount of such costs will be deducted from the Contractor's progress payment.

Inspection of the Contractor's layout by the Engineer and the acceptance of all or any part of it will not relieve the Contractor of their responsibility to secure the proper dimensions, grades and elevations for the work.

**Record Drawings**

The Contractor will maintain a record set of plans at the job site. These will be kept legible and current and will show all changes or work added in a contrasting, reproducible color. Two weeks prior to issuance of substantial completion, the Contractor will submit, prior to final inspection, corrected landscape drawings showing the location of all utility services, controller, pipe, valves and wiring. The Engineer will be the sole
judge as to the acceptability of the record plans and receipt of an acceptable set is a pre-requisite for final payment.

**Measurement and Payment**

No direct method of measurement will be made for construction stakes, lines and grades.

9. **105 CONTROL OF WORK.** Add the following to Subsection 105.15 ACCEPTANCE, paragraph (B) Final Acceptance:

A. **SUBSTANTIAL COMPLETION**

The work may be judged substantially complete when all construction has been completed with the possible exception of final inspection punch list work. The purpose of granting or acknowledging substantial completion is to stop contract time. This is particularly important to the Contractor if contract time is exhausted or nearly so and/or punch list work is anticipated to extend beyond the allotted time. Granting of substantial completion will eliminate the possibility of incurring liquidated damages or additional liquidated damages beyond the substantial completion date, whichever case may apply.

In the event that the Engineer grants substantial completion, the Contractor will have thirty (30) days thereafter to complete punch list work, unless additional time is granted--in writing--by the Engineer. In no case will a Contractor be granted more than thirty (30) days to complete punch list work, unless there are extenuating circumstances such as delay in shipment of a specialized piece of equipment, labor strike, or other circumstances beyond the Contractor's control which would necessitate a further time extension.

B. **PENALTY FOR FAILURE TO COMPLETE PUNCH LIST WORK WITHIN SPECIFIED TIME**

In the event the Contractor fails to complete the punch list work within thirty (30) days following the contract completion date, or in the case of specialized situations within the additional time allotted by the Engineer, the Contractor may be declared in default, and the Engineer may order the work completed by others.

In the event of default, as described herein, the Engineer will withhold from the Contractor's final payment, an amount equal to at least twice the estimated cost of the remaining work. In addition, the Engineer will withhold the retention deducted from contract progress payments until all punch list work has been satisfactorily completed, whereupon twice the amount of the actual cost of completing the work will be deducted from the Contractor's final payment and the remaining funds, if any, including the contract retention, will be released in accordance with the conditions set forth in contract retention.

C. **CONTRACT RETENTION**

This project will not be considered complete until all work has been completed, including punch list work. Under no circumstances will a Contractor receive any portion of the legally retained progress payments until the City has granted a final acceptance and/or acknowledged substantial completion. The following conditions will apply to each case:

1. **Substantial Completion:** The Engineer may reduce outstanding contract retention to not less than one (1) percent of the total contract amount, upon granting substantial completion, if the value of the punch list work is estimated to be less than one (1) percent of the total contract.
2. **Project Acceptance**: Project acceptance implies that all punch list work is done and the improvements have been accepted by the City. Under these conditions, the retention will be fully released to the Contractor subject only to the signing of the standard claims affidavit and hold harmless clause required for all contracts.

3. **Final Release of Contract Retention and/or Release of More Than Ninety (90) Percent of the Contract Funds**: Prior to final payment and release of monies retained and/or in the case of substantial completion where the Contractor has requested a reduction in contract retention, the Contractor will be required to sign a claims affidavit agreeing to hold the City harmless from any and all claims arising out of the contract.

10. **107 LEGAL REGULATIONS AND RESPONSIBILITY TO PUBLIC**, Add the following to **Subsection 107.1, LAWS TO BE OBSERVED, paragraph (C)**:

    While every effort has been made to Blue Stake all known utilities, and to research and show on the plans, all existing underground utilities based on the best available information, it will be the Contractor’s responsibility to locate and pothole all existing utilities sufficiently in advance of anticipated new underground construction to identify any potential conflicts and allow reasonable time for the Engineer to determine solutions. Any claims for additional compensation or work required due to the Contractor’s non-compliance with this provision will not be considered for payment by the City.

11. **107 LEGAL REGULATIONS AND RESPONSIBILITY TO PUBLIC**, Add the following new paragraphs to **Subsection 107.1, LAWS TO BE OBSERVED**:

    (G) **FAIR TREATMENT OF WORKERS**

    The Contractor will keep fully informed of all Federal and State laws, County and City ordinances, regulations, codes and all orders and decrees of bodies or tribunals having any jurisdiction or authority, which in any way affect the conduct of the work. He will at all times observe and comply with all such laws, ordinances, regulations, codes, orders and decrees; this includes, but is not limited to laws and regulations ensuring fair and equal treatment for all employees and against unfair employment practices, including OSHA and the Fair Labor Standards Act (FLSA). The Contractor will protect and indemnify the Contracting Agency and its representatives against any claim or liability arising from or based on the violation of such, whether by himself or his employees.

    (H) **DESERT TORTOISE MITIGATION**

    As stated in the Arizona Interagency Desert Tortoise Team (AIDTT) Management Plan (1996), if a desert tortoise is found in a project area, activities should be modified to avoid injuring or harming it. If activities cannot be modified, tortoises in harm’s way should be moved in accordance with Arizona Game and Fish Department’s “Guidelines for Handling Sonoran Desert Tortoises Encountered on Development Projects”, revised October 23, 2007 (or the latest revision), included in these contract provisions. Taking, possession, or harassment of a desert tortoise is prohibited by State law, unless specifically authorized by Arizona Game and Fish Department.

12. **107 LEGAL REGULATIONS AND RESPONSIBILITY TO PUBLIC**, Add the following to **Subsection 107.2, PERMITS**:

    1. **HAUL PERMIT**

    On any project, when the quantity of fill or excavation to be hauled exceeds 10,000 C.Y. or when the
duration of the haul is for more than twenty (20) working days, the Contractor will:

A. Obtain approval of the proposed haul route, number of trucks, etc., by the Water Services Department, and then;

B. Submit the proposed haul route plan to the Planning and Development Department and pay the appropriate plan-review fee (contact Planning and Development Department at 602-534-5933 for current plan review fee, the cost of which will be considered incidental to the project), and after their approval;

C. Obtain the written haul permit from the Planning and Development Department.

**NOTE:** Obtaining the haul permit and the approval by Street Transportation does not release the Contractor from strict compliance with MAG Subsection 108.5, Limitation of Operations.

2. **STORM WATER POLLUTION PREVENTION PLAN AND AZPDES PERMIT**

Any project that disturbs 1 acre or more of the ground surface requires the Contractor to obtain an AZPDES permit and prepare a SWPPP. This project does require an AZPDES permit and SWPPP.

3. **DUST PERMIT**

Any project that disturbs more than 1/10 acre of soil requires an earthmoving permit from Maricopa County. Information and forms can be found at:


To facilitate and encourage strict compliance with the Maricopa County Air Pollution Control Regulations pertaining to fugitive dust control, the Contractor will submit the following documentation to the Engineer at the Pre-Construction meeting prior to conducting any earth moving or dust generating activities under the Contract.

a. Copy of a valid Maricopa County Earth Moving (Dust Control) Permit applicable to the work or services under the Contract.

b. Copy of the Dust Control Plan applicable to the work or services under the Contract.

c. Documentation that all of the Contractor’s on-site project managers have received the Comprehensive or Basic dust control training as required by Maricopa County Rule 310 based on project disturbed acres.

For construction sites where 5-acres or more are disturbed, the Contractor will designate and identify to the City an individual who has completed the dust control training as required for the site Dust Control Coordinator. The Dust Control Coordinator will be present on-site all times that earth moving or dust generating activities are occurring and until all ground surfaces at the site have been stabilized.

For construction sites less than 1-acre, the Contractor will designate an individual who has completed Basic Training to be on site at all times that earth moving or dust generating activities are occurring.

The Contractor will notify the Engineer within twenty-four (24) hours of any inspection, Notice of Violation, or other contact by the Maricopa County Air Quality Department with it or any of its
subcontractors regarding the work or services under the Contract. A copy of any written communications, notices or citations issued to Contractor or any of its subcontractors regarding the work or services under the Contract will likewise be transmitted to the Engineer within twenty-four (24) hours.

The Contractor will prevent any dust nuisance due to construction operations in accordance with MAG Specifications, Section 104.1.3, Cleanup and Dust Control. The Contractor will use a power pick-up broom as part of the dust control effort. No separate measurement or payment will be made for cleanup or dust control, or for providing a power pick-up broom on the job.

The Contractor agrees to indemnify and reimburse the City for any fine, penalty, fee or monetary sanction imposed on the City by Maricopa County arising out of, or caused by the performance of work or services under the Contract. The Contractor will remit payment of the reimbursable sum to the City within thirty (30) days of being presented with a demand for payment from the City.

5. TEMPORARY RESTRICTION AND CLOSURE SYSTEM (TRACS) PERMIT

The Contractor will obtain a TRACS permit for any construction that restricts access (partial or complete closures) on Major/Collector public streets, or complete closures on Local streets, sidewalks, bike lanes and alleys. The Contractor will obtain this permit in accordance with the City of Phoenix Traffic Barricade Manual, latest edition. The Contractor will follow all requirements of the TRACS permit during construction. The Contractor will obtain this permit before the Notice to Proceed date. Any construction delays caused by non-compliance with the TRACS permit or the City of Phoenix Traffic Barricade Manual requirements will be the responsibility of the Contractor.

6. OTHER PERMITS

The Contractor may be required to obtain other permits from other agencies, such as the Arizona Department of Transportation (ADOT) or the Flood Control District of Maricopa County (FCDMC) before beginning work or restricting traffic in their right-of-way. The Contractor will be required to obtain these permits and comply with their requirements.

13. 107 LEGAL REGULATIONS AND RESPONSIBILITY TO PUBLIC, Revise the title of Subsection 107.4 ARCHAEOLOGICAL REPORTS to 107.4 ARCHAEOLOGICAL MONITORING AND DISCOVERIES, and add the following:

If suspected archaeological materials are discovered during construction without an archaeologist present, the Contractor will stop work immediately within a 10-meter zone of the discovery, secure the area, and immediately notify the City Archaeology Office (602-495-0901). The Contractor will not recommence work in the area of discovery until directed in writing by the City Archaeology Office.

14. 107 LEGAL REGULATIONS AND RESPONSIBILITY TO PUBLIC, Modify Subsection 107.8, USE OF EXPLOSIVES as follows:

Replace the words "Uniform Fire Code" with “Phoenix Fire Code”.

15. 107 LEGAL REGULATIONS AND RESPONSIBILITY TO PUBLIC, Add the following to Subsection 107.8, USE OF EXPLOSIVES:

While geotechnical information indicates some areas of hard rock, NO BLASTING will be allowed on this project due to the close proximity of two critical 66-inch transmission water mains, as well as many businesses.
16. **107 LEGAL REGULATIONS AND RESPONSIBILITY TO PUBLIC**. Add the following to Subsection 107.11, CONTRACTOR’S RESPONSIBILITY FOR UTILITY PROPERTY AND SERVICES:

**A. UNDERGROUND FACILITIES**

The Contractor will make whatever investigation it deems necessary to verify the location of underground utility facilities. If such facilities are not in the location shown in the drawings, then (regardless of whether this is discovered prior to or during construction) the contractor’s remedies, if any, pursuant to Art. 6.3, Chapter 2, Title 40, A.R.S. (A.R.S. 40-360.21 through 40-360.32, “Underground Facilities”), will be the contractor’s sole remedy for extra work, delays and disruption of the job, or any other claim based on the location of utility facilities. Locations of utility facilities shown on drawings furnished by the City are to be regarded as preliminary information only, subject to further investigation by the contractor. The City does not warrant the accuracy of these locations, and the contractor, by entering into this contract, expressly waives and disclaims any claim or action against the City under any theory for damages resulting from location of utility facilities.

The Contractor will be responsible for obtaining all Blue Stake utility location information, and for performing all requirements as prescribed in A.R.S. 40-360.21 through .29, for all underground facilities, including those that have been installed on the current project, until the project is accepted by the City.

At least two (2) working days prior to commencing any excavation, the Contractor will call the BLUE STAKE CENTER, between the hours of 7:00 a.m. and 4:30 p.m., Monday through Friday for information relative to the location of buried utilities. The number to be called is as follows:

Maricopa County       (602) 263-1100

**B. UTILITY-RELATED CONSTRUCTION DELAY DAMAGES CLAIM PROCEDURES**

The following procedure is intended to provide a fair and impartial process for the settlement of construction delay claims associated with unknown or improperly located utility facilities.

The Contractor will immediately notify, in writing, the Project Engineer of any potential utility-related delay claim.

The Contractor will immediately notify the appropriate liaison of the affected utility verbally, followed by a written notification.

The Contractor will coordinate an investigation of the situation with the affected utility and the City’s Utility Coordinator. After resolution, the Contractor will provide written notification of the settlement of the claim to all affected parties. If the affected utility makes a decision to handle negotiations for a claim, their personnel will be responsible for monitoring the project and all negotiations with the Contractor regarding the claim.

The Contractor will determine to document requirements of the affected utility for their acceptance of responsibility for the claims. The Contractor will provide four (4) copies of the required documentation to the utility involved and two (2) copies of this documentation to the Project Engineer. The Contractor will obtain written confirmation from the utility company involved of their documentation requirements.

17. **108 COMMENCEMENT, PROSECUTION AND PROGRESS** Add the following to Subsection 108.2,
SUBLETTING OF CONTRACT:

(F) PROMPT PAYMENT

1. Contractor Payment to Subcontractor or Supplier

Contractor will pay its subcontractors or suppliers within seven (7) calendar days of receipt of each progress payment from the City. The Contractor will pay for the amount of work performed or materials supplied by each subcontractor or supplier as accepted and approved by the City with each progress payment. In addition, any reduction of retention by the City to the Contractor will result in a corresponding reduction to subcontractors or suppliers who have performed satisfactory work. Contractor will pay subcontractors or suppliers the reduced retention within fourteen (14) days of the payment of the reduction of the retention to the Contractor. No Contract between Contractor and its subcontractors and suppliers may materially alter the rights of any subcontractor or supplier to receive prompt payment and retention reduction as provided herein. If the Contractor fails to make payments in accordance with these provisions, the City may take any one or more of the following actions and Contractor agrees that the City may take such actions: (1) to hold the Contractor in default under this agreement; (2) withhold future payments including retention until proper payment has been made to subcontractors or suppliers in accordance with these provisions; (3) reject all future bids from the Contractor for a period not to exceed one year from substantial completion date of this project; or (4) terminate agreement.

2. Alternative Dispute Resolution Between Contractor and Subcontractor or Supplier

If Contractor’s payment to a subcontractor or supplier is in dispute, Contractor and subcontractor or supplier agree to submit the dispute to any one of the following dispute resolution processes within fourteen (14) calendar days from the date that any party involved gives written notice to the other party(ies): (1) binding arbitration; (2) a form of alternative dispute resolution (ADR) agreeable to all parties; or (3) a City of Phoenix facilitated mediation. When disputed claim is resolved through ADR or otherwise, the Contractor and subcontractor or supplier agree to implement the resolution within seven (7) calendar days from the resolution date.

3. Inspection and Audit

Contractor, its subcontractors and suppliers will comply with A.R.S. 35-214 and the City will have all rights and remedies to inspect and audit the records and files of Contractor, subcontractor or supplier, as afforded the State of Arizona in accordance with the provisions of A.R.S. Section 35-214.

4. Non-Waiver

Should the City fail or delay in exercising or enforcing any right, power, privilege, or remedy under this Section, such failure or delay will not be deemed a waiver, release, or modification of the requirements of this Section or of any of the terms or provisions thereof.

5. Inclusion of provisions in Subcontracts

Contractor will include these prompt payment provisions in every subcontract, including procurement of materials and leases of equipment for this Agreement.

6. No Third Party Benefits or Rights

Nothing contained in this Agreement is intended to benefit or confer any rights on any person or entity.
not a party to this Agreement, and no such person or entity, including but not limited to other Contractors, subcontractors or suppliers, may assert any claim, cause of action, or remedy against the City hereunder.

18. 108 COMMENCEMENT, PROSECUTION AND PROGRESS, Add the following to Subsection 108.4, CONTRACTOR’S CONSTRUCTION SCHEDULE:

No later than one (1) week after the Pre-Construction meeting (or one week after the Notice to Proceed date is firmly established), the Contractor will submit to the Engineer, two (2) copies of a detailed Critical Path Model (CPM) chart outlining the detailed progress of all major and critical elements of the project by weeks, from beginning of project to end. The chart will begin at the established Notice to Proceed date and progress on a calendar basis, week by week, to the end of the project.

The Contractor will submit updated CPM charts as required by the Engineer. This will typically be on a monthly basis. The required submittals of updated CPM charts may be less frequent than monthly, if approved by the Engineer.

Neither the City nor the Engineer will accept liability or responsibility for the reasonable or workable nature of the CPM schedules prepared and submitted by the Contractor—that responsibility will remain with the Contractor.

19. 108 COMMENCEMENT, PROSECUTION AND PROGRESS, Add the following to Subsection 108.5, LIMITATION OF OPERATIONS:

A. WORK HOURS

Regular working hours will be defined as one 8-1/2 hour shift per day, Monday through Friday, exclusive of City holidays.

Work in excess of regular working hours will be defined as overtime. For overtime which becomes necessary, the Contractor will make a written request to the Engineer at least eight (8) calendar days before the desired overtime. The request will include the duration, dates, times, reason for overtime, and a statement of the consequences if overtime is not approved.

The Contractor will not schedule any overtime work which requires inspection, survey, or material testing without written permission from the Engineer two (2) working days before the proposed overtime work. The Engineer reserves the right to deny the requested overtime. If an overtime request is denied, the Engineer may extend the contract time at no additional cost to the City, including extended overhead costs.

Unscheduled Overtime

Overtime that is not requested and approved in accordance with the above procedure will be defined as unscheduled overtime. All costs (including appropriate overhead) will be paid by the Contractor by deduction from the contract.

Emergency Overtime

An emergency is defined as work required for a situation that is not within the Contractor's control.

With the Engineer's approval, the Contractor will be permitted to work overtime without being
City's Right to Perform and Terminate for Cause

If the City provides the Contractor with a written order to provide adequate maintenance of traffic, adequate cleanup, adequate dust control or to correct deficiencies or damage resulting from abnormal weather conditions, and the Contractor fails to comply in a time frame specified, the City may have work accomplished by other sources at the Contractor's expense.

If Contractor persistently fails to (i) provide a sufficient number of skilled workers, (ii) supply the materials required by the Contract Documents, (iii) comply with applicable Legal Requirements, (iv) timely pay, without cause, Sub-consultants and/or Subcontractors, (v) prosecute the Contract Services with promptness and diligence to ensure that the Contract Services are completed by the Contract Time, as such times may be adjusted, or (vi) perform material obligations under the Contract Documents, then the City, in addition to any other rights and remedies provided in the Contract Documents or by law, will have the rights set forth below.

Upon the occurrence of an event set forth above, City may provide written notice to Contractor that it intends to terminate the Agreement unless the problem cited is cured, or commenced to be cured, within seven (7) days of Contractor's receipt of such notice.

If Contractor fails to cure, or reasonably commence to cure, such problem, then City may give a second written notice to Contractor of its intent to terminate within an additional seven (7) day period.

If Contractor, within such second seven (7) day period, fails to cure, or reasonably commence to cure, such problem, then the City may declare the Agreement terminated for default by providing written notice to Contractor of such declaration.

Upon declaring the Agreement terminated pursuant to the above, City may enter upon the premises and take possession, for the purpose of completing the Work, of all materials, equipment, scaffolds, tools, appliances and other items thereon, which have been purchased or provided for the performance of the Work, all of which Contractor hereby transfers, assigns and sets over to City for such purpose, and to employ any person or persons to complete the Work and provide all of the required labor, services, materials, equipment and other items.

In the event of such termination, Contractor will not be entitled to receive any further payments under the Contract Documents until the Work will be finally completed in accordance with the Contract Documents. At such time, the Contractor will only be entitled to be paid for Work performed and accepted by the City prior to its default.

If City's cost and expense of completing the Work exceeds the unpaid balance of the Contract Price, then Contractor will be obligated to pay the difference to City. Such costs and expense will include not only the cost of completing the Work, but also losses, damages, costs and expense, including attorneys’ fees and expenses, incurred by the City in connection with the re-procurement and defense of claims arising from Contractor’s default.
TERMINATION FOR CONVENIENCE

The Owner for its own convenience has the right for any reason and at any time to terminate the contract and require the Contractor to cease work hereunder. Such termination will be effective at the time and in the manner specified in the notification to the Contractor of the termination. Such termination will be without prejudice to any claims which the Owner may have against the Contractor. In the event of a termination for convenience, the Contractor will be paid only the direct value of its completed work and materials supplied as of the date of termination, and Contractor will not be entitled to anticipated profit or anticipated overhead or any other claimed damages from the Owner, Architect or the Engineer.

If the City is found to have improperly terminated the Agreement for cause or default, the termination will be converted to a termination for convenience in accordance with the provisions of this Agreement.

CANCELLATION OF CONTRACT FOR CONFLICT OF INTEREST

All parties hereto acknowledge that this agreement is subject to cancellation by the City of Phoenix pursuant to the provisions of Section 38-511, Arizona Revised Statutes.

22. 109 MEASUREMENTS AND PAYMENT

Add the following to Subsection 109.2, SCOPE OF PAYMENT:

A. PARTIAL PAYMENTS

The contracting agency will make a partial payment to the Contractor on the basis of an approved estimate prepared by the Engineer or the Contractor for work completed and accepted through the preceding month. The notice to proceed date, which is designated for the specific project involved, will be used as the closing date of each partial pay period. Payment will be made no later than fourteen (14) days after the work is certified and approved. City will review payment requests and make recommendation of approval or denial within seven (7) calendar days.

B. PAYMENT RETENTION

At the start of construction, ten percent of all pay requests will be retained by the City to guarantee complete performance of the contract. When the work is fifty percent complete, this amount may be reduced to five percent providing that construction progress and quality of work is acceptable to the City. Any funds which are withheld from the contractor will be paid no later than sixty days after completion of the contract and settlement of all claims.

In lieu of retention, the contractor may provide as a substitute, an assignment of time certificates of deposit (CDs) from a bank licensed by Arizona, securities guaranteed by the United States, securities of the United States, the State of Arizona, Arizona counties, Arizona municipalities, Arizona school districts, or shares of savings and loan institutions authorized to transact business in Arizona.

Securities deposited in lieu of retention must be deposited into a separate account with a bank having a branch located in the City of Phoenix and be assigned exclusively for the benefit of the City of Phoenix pursuant to the City’s form of escrow agreement.

CDs assigned to the City must be maintained in the form of time deposit receipt accounts. CDs will be assigned exclusively for the benefit of the City of Phoenix pursuant to the City’s form of escrow agreement.

Escrow Agreement forms may be obtained from the Contract Specialist assigned to the project.
23. **109 MEASUREMENTS AND PAYMENTS.** Add the following to **Subsection 109.4.3, DUE TO EXTRA WORK:**

ALOWANCE FOR EXTRA WORK

Contract allowance items are provided for the purpose of encumbering funds to cover the costs of possible change order work. The amount of the allowance item is determined by the Engineer and is not subject to individual bid pricing. All bidders will incorporate the amount pre-entered in the bid proposal and will reflect the same in the total amount bid for this project.

This allowance item provides an estimated funding to cover unforeseen changes that may be encountered and corresponding extra work needed to complete the contract per plan. Unforeseen extra work, if any, will be as approved by the Engineer; for example, extension of unit bid prices, negotiated price or time and material, in accordance with MAG Specification Section 109.4 and 109.5.

It will be understood that this allowance item is an estimate only and is based on change order history of similar projects. It will not be utilized without an approved contract change order. It is further understood that authorized extra work, if any, may be less than the allowance item.

24. **109 MEASUREMENTS AND PAYMENTS,** Add the following to **Subsection 109.4 COMPENSATION FOR ALTERATION OF WORK:**

109.4.7 CHANGE ORDERS

Owner reserves the right to decrease adjustments made in any change order if, upon audit of Contractor's records, the audit discloses contractor provided false or inaccurate cost and pricing data in negotiating the change order. In enforcing this provision, the parties will follow the procedure provided in the Federal Acquisition Regulation (FAR) clause 52.214-27, found in 48 CFR Part 52.

25. **109 MEASUREMENTS AND PAYMENTS.** Delete Table 109-1 in **Subsection 109.9, DOLLAR VALUE OF MAJOR ITEM,** and substitute the following:

<table>
<thead>
<tr>
<th>CONTRACT AMOUNT</th>
<th>MAJOR ITEM IS DEFINED AS ANY ITEM EQUAL TO OR GREATER THAN THE FOLLOWING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to $1 million</td>
<td>$15,000 or 3%, whichever is greater</td>
</tr>
<tr>
<td>$1 million to $3 million</td>
<td>3% of the original contract amount to a maximum of $75,000.00</td>
</tr>
<tr>
<td>$3 million to $5 million</td>
<td>2.5% of the original contract amount to a maximum of $90,000.00</td>
</tr>
<tr>
<td>Over $5 million</td>
<td>1.5% of the original contract amount to a maximum of $125,000.00</td>
</tr>
</tbody>
</table>

**CONTINGENCY ITEMS**

Contingency items which fall under the definition of a major item are subject to negotiation if decreased by more than twenty (20) percent.
Contingency items will not increase more than twenty (20) percent without being subject to renegotiation, regardless of the percentage of that item relative to the total contract amount.

26. **NOTIFICATION OF CHANGED CONDITIONS AND DISPUTE RESOLUTION**  
Add the following to **Subsection 110.1 GENERAL**:

**SOILS INFORMATION**

The material boring logs and seismic refraction survey data shown on the plans or included in these specifications are included for the Contractor's convenience only. It is not intended to imply that the character of materials shown in the logs is representative throughout the project. **The soil borings are indicative of the soil characteristics only at the location and to the depth of each of the borings.**

Even if not specifically shown in the geotechnical information provided, the Contractor may encounter large cobbles, boulders, caliche, conglomerate, hard rock, perched groundwater, historic or prehistoric cultural resources, or other differing site conditions on this project. **No additional compensation will be made for any differing site condition that may be encountered.**
SPECIAL PROVISIONS

1. **201 CLEARING AND GRUBBING.** Add the following new **Subsection 201.8, DEMOLITION OF BUILDING:**

   **Description**

   The Contractor will completely remove the existing equipment and debris shown on sheet C2 of the plans.

   **Construction Requirements**

   The Contractor will contact the Water Services Department to plug and/or turn off water and sewer services. The Contractor will contact the appropriate utility companies to disconnect gas, electric, cable, TV, telephone and any other private utility services.

   The Contractor will promptly remove all building materials and debris resulting from demolition as it accumulates. Material will not be stored on-site or in the right-of-way. Any salvaging operations must be done at another site away from the demolition/construction area. No burning of any debris will be allowed on-site. If the Contractor fails to remove excess debris promptly, the Engineer reserves the right to cause same to be removed at the Contractor's expense.

   The Contractor will obtain and pay for the demolition permit. The method of demolition must be approved by the Building Official and the Engineer.

   Demolition will include complete removal and disposal of all debris, including floor slabs and items below grade, such as footings, pipes, structures, etc.

   Concrete removal shall require asbestos testing per OSHA requirements.

   **Measurement and Payment**

   Measurement and payment will be lump sum.

2. **211 FILL CONSTRUCTION.** Add the following to **Section 211 FILL CONSTRUCTION:**

   **211.1 DESCRIPTION**

   The work under this item will consist of constructing the roadway embankment to the lines and grades shown on the plans and in conformance with MAG Sections 210 and 211.

   Every effort was made during the design phase to balance the earthwork. The estimated quantity of borrow material required to complete fill construction, in-place, is 37,000 cubic yards. Cross section sheets are included in the plans for the Contractor to verify this approximate quantity.

   Imported borrow shall consist of granular material with a Plasticity Index (PI) of less than 15.

   **211.6 MEASUREMENT**

   The quantities of fill construction used to construct embankments or dikes will be those of the complete bid item, in place, within the limits of dimensions shown on the plans.

   Estimated quantity of Fill – Screened Native (Including New Levee) is 18,600 cubic yards for the Base Bid and
2,400 cubic yards for Alternate A.

Estimated quantity of Engineered Fill is 11,500 cubic yards for the Base Bid, 2,600 cubic yards for Alternate A and 2,000 cubic yards for Alternate D.

211.6 PAYMENT

Quantities of fill construction will be paid for at the contract unit price per cubic yard of fill as stipulated in the proposal. Such price shall include placing and compaction and all related work as specified above.

No payment will be made for fill construction to replace unsuitable material or for fill for holes, pits, and other depressions. The cost thereof shall be included in the price bid for the construction of the items to which such fill is incidental or appurtenant.

3. Add the following new Section, **232 STORM WATER POLLUTION PREVENTION – BEST MANAGEMENT PRACTICES:**

**Description**

Implementation of "Best Management Practices" (B.M.P.’s) to reduce stormwater pollution will be undertaken by the Contractor on a multi-tiered, most cost-effective approach. The Contractor will utilize the lowest-cost acceptable B.M.P. available to address each type of potential stormwater pollution situation encountered on the project. Should this prove ineffective in resolving the stormwater pollution problem, additional, higher-cost B.M.P.’s may need to be employed, upon approval by the City.

**Construction Requirements**

Typical multi-tiered B.M.P. approaches to construction operations may include:

A. ROADWAY SUBGRADE EXCAVATION:

1. Tier I - The excavated area will create, in effect, a temporary retention area. This may provide adequate control of storm runoff to prevent sediment from leaving the site. Pumping or other methods utilized to drain the excavation will employ filter fabric or other filtering method to remove sediment before leaving the site or entering the storm drain system.

2. Tier II - Catch basin inlet protection (utilizing filter fabric, gravel, etc.) may be necessary should Tier I controls prove inadequate. Care will be exercised to ensure that Tier II B.M.P.’s do not result in blockage of drainage and resultant flooding of adjacent properties.

B. OPEN PIPELINE TRENCHES:

1. Tier I - The open trench itself will act as a temporary retention area. The Contractor will provide a low-cost, readily-installed/removed temporary device on the open end of the pipe to prevent sediment-laden stormwater from entering the pipe. This may consist of a temporary "plug" incorporating filter fabric, a temporary weir, or other device capable of removing sediment before allowing stormwater to enter the pipe. Care must be taken to prevent damming of floodwaters in the excavation that could result in "floating" the pipe.

2. Tier II - If Tier I protection does not prove satisfactory, the Contractor may need to install straw bales, sandbag berms, or temporary diversion dikes around the perimeter of the open
excavation to prevent sediment-laden stormwater from entering the open excavation. Due to installation/removal time, such devices need only be installed during periods of likely precipitation and runoff. Earthen dikes are the preferred alternate, due to ease of installation and removal. Care must be taken to assure that runoff is not blocked to the extent that flooding of adjacent properties will result.

C. BACKFILLED PIPELINE TRENCHES:

1. Tier I - As with roadway subgrade excavations, pipeline trenches which have been backfilled but not yet paved will be several inches lower than adjacent pavement areas, and will therefore act as temporary retention areas.

2. Tier II - If the "retention" provided by the backfilled area does not prevent sediment-laden runoff from leaving the excavated area, perimeter controls such as silt fence, straw bales, sandbag berms, or gravel filter berms may need to be installed around the downstream edge(s) of the backfilled area. As with open trenches, the selection of the appropriate measure, extent of its application, and time period during which it is needed will be dependent upon cost, site conditions, ease of installation/removal, and likelihood of precipitation/runoff. Again, care must be taken to ensure that diversion of stormwater onto adjacent properties does not result from these installations.

Another stormwater control method, which the Contractor may need to consider, is limiting the amount of area disrupted and therefore subject to sediment-laden stormwater runoff at any one time. Should such project phasing prove necessary due to the failure of other B.M.P.'s, the Contractor will revise his construction activities accordingly, at no additional cost to the City.

Standards for installation of the above B.M.P.'s are provided in the Flood Control District of Maricopa County's "Drainage Design Manual for Maricopa County, Arizona, Volume III, Erosion Control". Installation and operation of B.M.P.'s will be in accordance with that manual.

There will be no separate measurement or payment for preparing or developing Storm Water Pollution Prevention Plans, or for preparing NOI's or NOT's or obtaining an AZPDES Permit, all these costs being considered incidental to the cost of the project.

Use of individual BMP items will conform to the Contractor's approved Storm Water Pollution Prevention Plan (SWPPP).

Measurement and Payment

Payment for various types of necessary BMP’s will be made from the general Allowance for Extra Work based on approved invoiced cost of the materials only, plus taxes, and a maximum 15 percent markup for overhead and profit. There will be no separate measurement or payment for the preparation or development of the Storm Water Pollution Prevention Plan; labor or equipment necessary to install, maintain or remove the BMP materials; moving existing BMP materials from one location to another on the same project; or constructing BMP swales or berms, all of these costs being considered incidental to the cost of the project.

4. 301 SUBGRADE PREPARATION: Add the following to Subsection 301.1, DESCRIPTION:

The work under Subgrade Preparation consists of all excavating and grading work necessary to bring the existing surface to the section specified on the plans prior to the covering of the prepared subgrade with
pavement base materials.

5. **301 SUBGRADE PREPARATION.** Delete Subsections 301.7, MEASUREMENT, and 301.8, PAYMENT, and substitute the following:

**301.7 MEASUREMENT AND PAYMENT:**

No separate measurement or payment will be made for subgrade preparation. The cost is considered included in the bid price for Excavation, Fill - Screened Native and Engineered Fill.

6. **321 PLACEMENT AND CONSTRUCTION OF ASPHALT CONCRETE PAVEMENT.** Add the following to Subsection 321.1 DESCRIPTION:

The permanent asphalt concrete roadway pavement section will consist of the following:

**PAVEMENT THICKNESS**

A. Depending on paving location three pavement sections are specified and identified on design drawings:

1. Type A Pavement

   a. Type A pavement section is used for drying beds on the bottom and sides including 24-inch shoulder section on the inner side of the levees.

   b. Provide a minimum of 5-inch compacted premixed base course for a total compacted depth of 5-inches or according to thickness detailed on the Drawings for pavement where shown on the Drawings.

   c. The AC pavement shall be placed on top of 6 inches of scarified and compacted subgrade. Subgrade shall be moisture conditioned and compacted to 100 percent of relative compaction as evaluated by ASTM D 698.


2. Type B Pavement

   a. Type A pavement section is used for access roads and access ramps.

   b. Provide a minimum of 7.5-inch compacted premixed base course for a total compacted depth of 7.5-inches or according to thickness detailed on the Drawings for pavement where shown on the Drawings.

   c. The AC pavement shall be placed on top of 6 inches of scarified and compacted subgrade. Subgrade shall be moisture conditioned and compacted to 100 percent of relative compaction as evaluated by ASTM D 698.

3. Type C Pavement

a. Type C pavement section can be used in all paving areas including drying beds, access roads, and ramps. This section is alternative to the Type A and B paving sections specified above.

b. Provide a minimum of 5-inch compacted premixed base course for a total compacted depth of 5-inches or according to thickness detailed on the Drawings for pavement where shown on the Drawings.

c. The AC pavement shall be placed on top of 8 inches of compacted and graded AB coarse. AB coarse shall be compacted to 100 percent of maximum dry density as evaluated by ASTM D 698.

d. AC and subbase shall be placed on top of remedial grading as detailed in the geotechnical report prepared by Ninyo & Moore: “Geotechnical Evaluation 91st Ave. WWTP Sludge Solar Drying Beds”, dated August 5, 2016.

B. All sides of the asphalt area shall be curbed flush with edge of asphalt, unless otherwise shown on the drawings, to retain the asphalt during placement and protect edges from damage by heavy equipment.

MATERIALS

A. Base Course:

1. Base course material shall be a A 1 1/2 hot mix asphalt concrete, consisting of a mixture of mineral aggregate and paving asphalt conforming to Section 710 of City of Phoenix Supplement to the MAG Standard Specifications. Gradation of the aggregate shall comply with the City of Phoenix Type A 1 1/2”.

2. The City of Phoenix Type A 1 1/2” asphalt shall contain a minimum of 4.3 percent oil.

B. Tack Coat: The tack coat shall be emulsified asphalt Type SS-1h according to MAG 329, unless directed otherwise by the ENGINEER.

14. 401 TRAFFIC CONTROL. Add the following to Subsection 401.5 GENERAL TRAFFIC REGULATION:

Safety Fencing Requirement for Trenches and Excavations

The Contractor will provide safety construction fencing around all open trenches and excavations during all non-working hours.

The Contractor will provide for the safety and welfare of the general public by adequately fencing all excavations and trenches that are permitted by the Engineer to remain open when construction is not in progress.

Fencing will be securely anchored to approved steel posts located six (6) feet on centers, having a minimum height of six (6) feet, and will consist of wire mesh fabric of sufficient weight and rigidity to adequately span a maximum supporting post separation of six (6) feet.
The fencing, when installed about the periphery of excavations and trenches, will form an effective barrier against intrusion by the general public into areas of construction. Fencing will not create sight distance restrictions or visual obstructions. At all times when construction is not in progress, the Contractor will be responsible for maintaining the fencing in good repair, and upon notification by the Engineer, will take immediate action to rectify any deficiency. Prior to the start of any excavating or trenching required for the execution of the proposed work, the Contractor will submit to the Engineer for approval, detailed plans showing types of materials and methods of fabrication for the protective fencing.

There will be no separate measurement or payment for furnishing, installing, or maintaining protective fencing. The cost will be considered incidental to the cost of the pipe and/or structures.

15. **505 CONCRETE STRUCTURES**, Add the following to Section 505 CONCRETE STRUCTURES:

**Classifications of Concrete:**

A. Type "1" concrete shall be steel reinforced and includes all concrete, unless indicated otherwise.

B. Type "2" concrete shall be placed without forms or with simple forms, with little or no reinforcing and includes the following:
   1. Concrete fill.
   2. Duct banks.
   3. Unreinforced encasements.
   4. Curbs and gutters.
   5. Sidewalks.
   6. Thrust blocks.

**Concrete Mix**

A. General
   1. Normal weight: 145 pounds per cubic foot.
   2. Use air-entraining admixture in all concrete: provide not less than four percent nor more than eight percent entrained air for concrete exposed to freezing and thawing, and from three percent to five percent for other concrete.

B. Proportioning and Design of Type “1” Mix:
   1. Minimum compressive strength at 28 days: 4,000 psi.
   2. Maximum water cement ratio by weight: 0.45.
   3. Minimum cement content: 564 pounds per cubic yard.

C. Proportioning and Design of Type “2” Mix:
   1. Minimum compressive strength at 28 days: 3,000 psi.
   2. Maximum water cement ratio by weight: 0.50.
   3. Minimum cement content: 517 pounds per cubic yard.

17. **530 PAINTING**, Add the following to Section 530 PAINTING:

See Technical Specification 09900.
18. **601 TRENCH EXCAVATION, BACKFILLING AND COMPACTION**, Add the following to **Subsection 601.2.6 Grading and Stockpiling** after the first paragraph:

During excavation, material suitable for backfilling will be piled in an orderly manner, a sufficient distance back from the edges of trenches, to avoid overloading and to prevent slides or cave-ins. Material unsuitable for backfilling, or excess material, will be hauled from the job site and disposed of by the Contractor.

19. **601 TRENCH EXCAVATION, BACKFILLING AND COMPACTION**, Add the following to **Subsection 601.2.7 Shoring and Sheeting**:

The Contractor will do such trench bracing, sheathing or shoring necessary to perform and protect the excavation as required for safety and conformance to governing laws. The bracing, sheathing or shoring will not be removed in one operation, but will be done in successive stages as determined by the Engineer to prevent overloading of the pipe during backfilling operations. The cost of the bracing, sheathing or shoring and the removal of same will be included in the unit price for the pipe.

20. **601 TRENCH EXCAVATION, BACKFILLING AND COMPACTION**, Add the following to **Subsection 601.2.8 Open Trench**:

Except where otherwise noted in the special provisions, or approved in writing by the Engineer, the maximum length of open trench, where the construction is in any stage of completion (excavation, pipe laying or backfilling), will not exceed 1,320 feet in the aggregate at any one location.

Any excavated area will be considered open trench until all ABC for pavement replacement has been placed and compacted. With the approval of the Engineer, pipe laying may be carried on at more than one separate location, the restrictions on open trench applying to each location. Trenches across streets will be completely backfilled as soon as possible after pipe laying.

Substantial steel plates with adequate trench bracing will be used to bridge across trenches at street crossings where trench backfill and temporary patches have not been completed during regular work hours. Safe and convenient passage for pedestrians will be provided. The Engineer may designate a passage to be provided at any point he deems necessary.

21. **601 TRENCH EXCAVATION, BACKFILLING AND COMPACTION**, Add the following new **Subsection 601.2.9 Pavement and Concrete Cutting and Removal**:

**601.2.9 Pavement and Concrete Cutting and Removal**: Where trenches lie within the Portland cement concrete section of streets, alleys, driveways or sidewalks, etc., such concrete will be sawcut to neat, vertical, true lines in such a manner that the adjoining surface will not be damaged. The minimum depth of cut will be 1 ½ inches or ¼ of the thickness, whichever is greater.

Asphalt pavement will be clean-cut with approved equipment and by approved methods in accordance with the requirements of Section 336.

No ripping or rooting will be permitted outside limits of cuts. Surfacing materials removed will be hauled from the job site immediately, and will not be permitted in the backfill.

22. **601 TRENCH EXCAVATION, BACKFILLING AND COMPACTION**, Add the following to **Subsection 601.4.3 Bedding for Storm Sewers Maintained by the City of Phoenix**:

All Controlled Low Strength Material (CLSM) will be provided by a commercial-source. No on-site mixing or
addition of cement to aggregate base course slurry in transit mixers will be allowed.

23. **601 TRENCH EXCAVATION, BACKFILLING AND COMPACTION**, Add the following to **Subsection 601.4.4**

Backfill:

**BACKFILL TYPE REQUIREMENTS FOR PIPE TRENCHES**

Type "B" backfill, as shown on City of Phoenix Detail P1200, will be used for all mainline pipe installations across major, collector, or other signalized intersections. At a minimum, the extent of the Type "B" backfill will be from curb-return-to-curb-return through the intersection, unless noted otherwise on the plans or in the special provisions. Type "B" backfill will also be used for all lateral pipe connections in ALL streets. Type "A-Modified" backfill (suitable native material as specified in City of Phoenix Supplement to MAG Specification Section 601.3.2, except that no piece larger than 3 inches will be allowed), as shown on City of Phoenix Detail P1200, may be used at all other locations, from the top of bedding to the specified pavement subgrade level, unless noted otherwise on the plans or in the special provisions. There is no separate measurement or payment for pipe backfill. The cost is considered included in the bid price for furnishing and installing the pipe. The pavement replacement section will be as specified on the plans or in the special provisions, and will be paid for by the square yard or by the ton, whichever is indicated in the special provisions and on the bid proposal.

24. **601 TRENCH EXCAVATION, BACKFILLING AND COMPACTION**, Add the following new **Subsection 601.4.5**

**Cutting Newly Placed Pavement for Pipe Installation:**

In the event temporary or base course pavement must be cut in order to install pipe, the cost of sawcutting, removing and replacing the asphalt will be considered incidental to the cost of the pipe.

25. **601 TRENCH EXCAVATION, BACKFILLING AND COMPACTION**, Add the following new **Subsection 601.6**

**PROTECTION OF EXISTING UTILITIES:**

**601.6.1 Utilities:** Unless otherwise shown on the plans or stated in the specifications, all utilities, underground or overhead, will be maintained in continuous service throughout the entire contract period. The Contractor will be responsible and liable for any damages to or interruption of service caused by the construction.

If the Contractor desires to simplify his operation by temporarily or permanently relocating or shutting down any utility or appurtenance, he will make the necessary arrangements and agreements with the owner and will be completely responsible for all costs concerned with the relocation or shutdown and reconstruction. All property will be reconstructed in its original or new location as soon as possible and to a condition at least as good as its previous condition. This cycle of relocation or shutdown and reconstruction will be subject to inspection and approval by both the Engineer and the owner of the utility.

The Contractor will be entirely responsible for safeguarding and maintaining all conflicting utilities that are shown on the plans (Sections 107 and 105 apply). This includes overhead wires and cables and their supporting poles whether they are inside or outside of the open trench. If, in the course of work, a conflicting utility line that was not shown on the plans is discovered, the Contracting Agency will either negotiate with the owner for relocation, relocate the utility, change the alignment and grade of the trench or as a last resort, declare the conflict as "extra work" to be accomplished by the Contractor in accordance with Section 104.

**601.6.2 Irrigation Ditches, Pipes and Structures:** The Contractor will contact the owners of all irrigation facilities, and make arrangements for necessary construction clearances and/or dry-up periods.
All irrigation ditches, dikes, headgates, pipe, valves, checks, etc., damaged or removed by the Contractor, will be restored to their original condition or better, by the Contractor at no additional cost to the Contracting Agency.

601.6.3 Building, Foundations and Structures: Where trenches are located adjacent to building, foundations and structures, the Contractor will take all necessary precaution against damage to them. The Contractor will be liable for any damage caused by the construction.

Except where authorized in the special provisions or in writing by the Engineer, water settling of backfill material in trenches adjacent to structures will not be permitted.

There will be no separate measurement or payment for this work. The Contractor will include all associated costs in the unit bid price for the pipe installation.

601.6.4 Permanent Pipe Support Options and Encasements: Where 18-inch or larger mainline pipes (or other pipes as directed by the Engineer) cross under existing sanitary sewerlines (vitrified clay pipe 12-inches or smaller), the Contractor will permanently support the sanitary sewerline per MAG Detail 403-1, 403-2 or 403-3. If the ductile iron pipe replacement option is used (403-3), and the required crossing length is more than one joint of pipe, concrete pipe supports as detailed in MAG Details 403-1 or 403-2 will be used in addition to the ductile iron pipe. For a single joint of standard 20-foot-long ductile iron pipe replacement, the maximum trench width allowed at the point of the sewer line crossing will be 9-feet, unless otherwise directed by the Engineer. Mechanical or restrained joints will be required on all multiple-joint ductile iron pipe crossings.

Where waterlines, reclaimed waterlines or sanitary sewer lines (new or existing) cross over or under each other, pipeline encasements will be provided as necessary in accordance with MAG Detail 404.

When the ductile iron pipe replacement option is used for the sewer lines, the new pipe will be properly blocked at each end with one or more bricks resting on undisturbed or 95% compacted soil haunches outside the trench walls to prevent differential settlement.

The interior of all ductile iron pipe used for sewer lines will be coated per the specification, "LINING FOR DUCTILE IRON PIPE USED FOR SEWER LINES" in these Special Provisions.

Upon completion of a sanitary sewer line support or encasement, including backfilling and compacting, but prior to permanent pavement replacement, the Contractor will request, through the Engineer, a televising of the line by the City Water Services Department to ensure proper line and grade of the sanitary sewer pipe. If the pipe is out of alignment, it will be the Contractor's responsibility to remedy the situation at no cost to the City.

If the sanitary sewer line is less than 8-inches in diameter, the Contractor will provide the necessary equipment and televising the line to determine proper pipe alignment. The Engineer will be present during the televising, and a video tape of the televising will be made for the City Water Services Department for confirmation that the pipe is properly aligned. The cost of televising the line and preparing the video tape will be included in the bid price paid for the pipe support or encasement.

Permanent pipe supports will be paid for at the unit price bid for each unit installed regardless of type. Encasements will be paid for at the unit price bid per linear foot installed regardless of type. The unit price bid for either item of work will be compensation in full for providing complete and satisfactory permanent pipe supports or encasements, including ductile iron pipe and fittings, concrete, reinforcing steel, forming, vibrating, any required earthwork, televising and videotaping, and any other incidental items necessary.
601.6.5 **Electronic, Telephonic, Telegraphic, Electrical, Oil and Gas Lines:** During trenching operations, underground facilities such as electronic, telephonic, telegraphic, electrical, oil and gas lines will be supported and protected by the Contractor. Support for plastic pipes will be continuous along the bottom of the pipe. Support for metal pipe and electrical conduit may be continuous or nylon webbing may be used for suspension at no greater than ten-foot intervals.

The Contractor will avoid damaging any pipes, conduits or duct bank facilities during excavation, foundation and bedding placement, and trench backfilling and compaction.

601.6.6 **Measurement and Payment:**

There will be no measurement or payment for this work. The Contractor will include all associated costs in the unit bid price for the pipe installation.

26. **601 TRENCH EXCAVATION, BACKFILLING AND COMPACTION.** Add the following new Subsection

601.7 **CONTRACTOR CERTIFICATION OF INSTALLATION PROCEDURES:**

When requested in the Special Provisions or by the Engineer prior to installation, the Contractor will furnish to the Contracting Agency an affidavit (certification) from the pipe manufacturer (or his designee) stating that the Contractor is familiar with the manufacturer's suggested installation methods and procedures and the installation complies with those procedures and is consistent with MAG requirements.

Also, when required in the Special Provisions or requested by the Engineer, the pipe manufacturer or his designee will review the Contractor's methods and procedures for pipe installation in the field. The Contractor will make any adjustments in the installation as recommended by the manufacturer or his representative. If necessary, the Contractor may be required to reinstall or provide corrections to pipe installed prior to the field review at no cost to the Agency. Once the manufacturer or his representative has reviewed the Contractor's installation methods and the Contractor has adjusted his installation methods as recommended by the same, the manufacturer or his representative will furnish to the Contracting Agency an affidavit (certification) that the Contractor's installation methods and procedures, at the time of the review, complied with the manufacturer's installation practices. The affidavit must provide the name of the manufacturer's representative witnessing the pipe installation.

27. **625 MANHOLE CONSTRUCTION AND DROP SEWER CONNECTIONS.** Add the following to Subsection 625.2 MATERIALS:

Per City of Phoenix Water Services Department, "MAG Standard Detail 425: 24" Aluminum Manhole Frame and Cover" is **not approved** and will not be used in the City of Phoenix.

28. **625 MANHOLE CONSTRUCTION AND DROP SEWER CONNECTIONS.** Add the following to Subsection 625.3.1 MANHOLES:

If steps are inadvertently installed, they will be removed and the holes will be filled with epoxy or Class "B" concrete.

29. **727 STEEL REINFORCEMENT.** Add the following to Section 727 STEEL REINFORCEMENT:

REINFORCING MATERIALS
A. Reinforcing Bars: ASTM A 615, Grade 60 deformed bars.


C. Steel Wire: ASTM A 82.

30. **750 IRON WATER PIPE AND FITTINGS.** Add the following to Section 750 IRON WATER PIPE AND FITTINGS:

**EPOXY LINING MATERIAL**

Ductile iron pipe shall be epoxy lined for this project. The material shall be an amine cured novalac epoxy containing at least 20 percent by volume of ceramic quartz pigment. Epoxy lining material manufacturer shall demonstrate a successful history of lining pipe and fittings for sewer service and submit a test report verifying the following properties, and a certification of the test results.

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

B. The following test shall be run on coupons from factory lined ductile iron pipe:

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

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

   a) 20 percent Sulfuric Acid: No effect after two years.
   b) 25 percent Sodium Hydroxide: No effect after two years.
   c) 160°F Distilled Water: No effect after two years.
   d) 120°F Tap Water (Scribed panel): 0.0 undercutting after two years with no effect.

C. An abrasion resistance of no more than four mils loss after one million cycles - European Standard EN 598: 1994 Section 7.8 Abrasion Resistance.

D. Interior of the pipe shall receive 40 mils dry film thickness.

E. Applicator: The lining shall be applied by a competent firm with a successful history of applying linings to the interior of ductile iron pipe and fittings.

F. Surface Preparation: Pipe surfaces shall be cleaned and sand blasted prior to lining application in accordance with manufacturer’s recommended procedures.

G. Inspection and Certification:
1) All ductile iron pipe and fitting linings shall be checked for thickness using a magnetic film thickness gauge. The thickness testing shall be done using the method outlined in SSPC-PA-2 Film Thickness Rating.

2) The interior lining of all pipe barrels and fittings shall be tested for pinholes with a non-destructive 2,500 volt test. Any defects found shall be repaired prior to shipment.

3) The pipe or fitting manufacturer shall supply a certificate attesting to the fact that the applicator met the requirements of this specification.

4) Product and Manufacturer: Provide one of the following:
   a) Protecto 401
   b) Or equal
GUIDELINES FOR HANDLING SONORAN DESERT TORTOISES ENCOUNTERED ON DEVELOPMENT PROJECTS
Arizona Game and Fish Department
Revised October 23, 2007

The Arizona Game and Fish Department (Department) has developed the following guidelines to reduce potential impacts to desert tortoises, and to promote the continued existence of tortoises throughout the state. These guidelines apply to short-term and/or small-scale projects, depending on the number of affected tortoises and specific type of project.

The Sonoran population of desert tortoises occurs south and east of the Colorado River. Tortoises encountered in the open should be moved out of harm's way to adjacent appropriate habitat. If an occupied burrow is determined to be in jeopardy of destruction, the tortoise should be relocated to the nearest appropriate alternate burrow or other appropriate shelter, as determined by a qualified biologist. Tortoises should be moved less than 48 hours in advance of the habitat disturbance so they do not return to the area in the interim. Tortoises should be moved quickly, kept in an upright position parallel to the ground at all times, and placed in the shade. Separate disposable gloves should be worn for each tortoise handled to avoid potential transfer of disease between tortoises. Tortoises must not be moved if the ambient air temperature exceeds 40 degrees Celsius (105 degrees Fahrenheit) unless an alternate burrow is available or the tortoise is in imminent danger.

A tortoise may be moved up to one-half mile, but no further than necessary from its original location. If a release site, or alternate burrow, is unavailable within this distance, and ambient air temperature exceeds 40 degrees Celsius (105 degrees Fahrenheit), the Department should be contacted to place the tortoise into a Department-regulated desert tortoise adoption program. Tortoises salvaged from projects which result in substantial permanent habitat loss (e.g., housing and highway projects), or those requiring removal during long-term (longer than one week) construction projects, will also be placed in desert tortoise adoption programs. Managers of projects likely to affect desert tortoises should obtain a scientific collecting permit from the Department to facilitate temporary possession of tortoises. Likewise, if large numbers of tortoises (>5) are expected to be displaced by a project, the project manager should contact the Department for guidance and/or assistance.

Please keep in mind the following points:

- These guidelines do not apply to the Mohave population of desert tortoises (north and west of the Colorado River). Mohave desert tortoises are specifically protected under the Endangered Species Act, as administered by the U.S. Fish and Wildlife Service.
- These guidelines are subject to revision at the discretion of the Department. We recommend that the Department be contacted during the planning stages of any project that may affect desert tortoises.
- Take, possession, or harassment of wild desert tortoises is prohibited by state law. Unless specifically authorized by the Department, or as noted above, project personnel should avoid disturbing any tortoise.
CONSTRUCTION STORM WATER POLLUTION PREVENTION PLAN

Add the following new Section, **233 STORM WATER POLLUTION PREVENTION PLAN SUBMITTAL PROCESS**

**233.1 DESCRIPTION**

The Contractor will use the Arizona Department of Environmental Quality (ADEQ) Smart NOI program for all submittals located at this web address:

[https://az.gov/app/smartnoi/](https://az.gov/app/smartnoi/)

The location of this process may change and it is the responsibility of the Contractor to verify the correct web address. All fees are the responsibility of the Contractor. The Contractor will apply for a “Stormwater Construction General Permit” with the project type “MUNICIPAL/PUBLIC”.

Before any construction on site begins, the Contractor will submit the Notice of Intent (NOI) and the SWPPP through the Smart NOI program as the sole permittee. The Contractor will not commence any construction activities until the ADEQ send a written Notice Of Intent assigning an AZCON number.

As required by ADEQ the Contractor will submit a Notice of Termination (NOT) through the Smart NOI program. The Contractor will receive final payment only after receiving a written Notice of Termination Acknowledgement from ADEQ.

**Projects Impacting Impaired Waters**

Projects that will have any construction taking place within ¼ mile of the Salt River between 23rd Avenue and the confluence of the Gila River will impact “Impaired Waters”. These projects will require the Contractor to design, implement, and evaluate a Monitoring Plan for stormwater runoff from their construction activities. The Monitoring Plan must be site specific and will be submitted to ADEQ as an appendix to the SWPPP. ADEQ is the final authority in the approval of the monitoring plan. A copy of the SWPPP and the Monitoring Plan will be kept on-site at all times. Additional copies of the Monitoring Plan should be made available to all personnel who anticipate participating in stormwater monitoring activities. The Contractor will have a copy of the monitoring plan, approved SWPPP, NOI, and ADEQ Authorization to Discharge posted at the jobsite prior to ground disturbance.

**Subcontractors**

All subcontractors will comply with all AZPDES requirements under the supervision of the General Contractor, and will submit a completed, signed subcontractor certification form, thereby designating themselves as co-permittees.

**233.2 SAMPLE SWPPP STRUCTURE**

The following is a sample outline of the City requirement for a SWPPP submittal modeled after the ADEQ Construction General Permit Checklist. It will be the Contractor’s responsibility to meet all the ADEQ requirements for a SWPPP and retain a qualified consultant to complete the SWPPP if necessary at no additional cost to the City.
1 SITE DESCRIPTION

1.1 Project Name: CONTRACTOR WILL FILL IN PROJECT NAME

1.2 Project Location: CONTRACTOR WILL FILL IN FOR PROJECT SITE LOCATION

1.3 Owner’s Name:

City of Phoenix, Water Services Department

1.4 Owner’s Address:

200 West Washington Street, 8th Floor, Phoenix, Arizona 85003

1.5 Project Description: CONTRACTOR WILL FILL IN PROJECT DESCRIPTION

1.6 Runoff Coefficient and Soils Information:

A. Overall runoff coefficient of upstream drainage area will be unchanged by project.

B. Surface Soils Information: (EXAMPLE ONLY, CONTRACTOR WILL FILL IN FOR PROJECT SITE LOCATION)

<table>
<thead>
<tr>
<th>SOIL UNIT</th>
<th>SOIL TYPE (USDA TEXTURE)</th>
<th>PERMEABILITY (IN./HR.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laveen</td>
<td>Loam</td>
<td>0.6-2.0</td>
</tr>
<tr>
<td>Mohall</td>
<td>Clay Loam</td>
<td>0.2-0.6</td>
</tr>
<tr>
<td>Tucson</td>
<td>Clay Loam</td>
<td>0.2-0.6</td>
</tr>
<tr>
<td>Vcont</td>
<td>Clay</td>
<td>0.06-0.2</td>
</tr>
</tbody>
</table>

1.7 Name of Receiving Water:

EXAMPLE: SALT RIVER, CONTRACTOR WILL FILL FOR PROJECT SITE LOCATION

2 CONTROLS

2.1 Erosion and Sediment Controls

2.1.a Stabilization Practices:

Stabilization practices on this site include:

- Permanent planting.
- Save selected existing trees.
- Decomposed granite
- **CONTRACTOR WILL ADD OR REMOVE STABILIZATION PRACTICES AS NECESSARY**

2.1.b Structural Practices:
May include:
- Temporary retention areas (subgrade excavation areas).
- Temporary catch basin inlet protection.
- Silt fence.
- Gravel filter berm.
- Temporary diversion dike.
- Straw bale barriers.
- Sandbag berm
- **CONTRACTOR WILL ADD OR REMOVE STABILIZATION PRACTICES AS NECESSARY**

2.1.c Narrative: Sequence of major activities.
**CONTRACTOR WILL COMPLETE NARRATIVE**

2.1.d Storm Water Management:  **(CONTRACTOR WILL EDIT AS NECESSARY)**
Storm water drainage on will be provided by curb and gutter, catch basin inlets, and storm drains. No appreciable changes in runoff coefficients or in finished roadway grades will take place as a result of this project; therefore, no significant alterations of storm water drainage patterns or runoff quantities are expected.

During construction, storm water runoff will be managed by the following means, as conditions require:

- Temporary retention will be provided during roadway construction in areas excavated for subgrade.
- Silt fence, straw bales, sandbag berms, temporary diversion dikes, gravel filter berms or other BMP’s as necessary to eliminate erosion may be used to prevent storm runoff from entering open storm drain pipes in excavated trenches. Temporary catch basin inlet protection may also be provided to remove sediment from drainage water before it enters the drainage system. Straw bale protection at outfall pipe locations may be employed during construction.

3 **OTHER CONTROLS**

3.1 Waste Disposal:

**Waste Materials:**

All waste materials including trash and construction debris from the site will be either disposed to a designated area immediately or collected and stored in securely-lidded metal dumpsters. The dumpsters will meet all local and State solid waste management regulations. The dumpsters will be emptied a minimum of once per week, or more often if necessary, and the trash will be hauled to an acceptable dump site. Lids will be closed at all times after work hours and during rain events. No construction waste materials will be buried on site. All personnel will be instructed regarding the correct procedures for waste disposal. Notices stating these practices will be posted on site, and the site superintendent who manages the day-to-day site operations, will be responsible for seeing that these procedures are followed.
Concrete washout will only be allowed in designated areas. The hardened waste will be disposed of weekly and before final inspection of the project.

Hazardous Waste:

All hazardous waste materials will be disposed of in the manner specified by local or State regulations or by the manufacturer. Site personnel will be instructed in these practices, and the site superintendent who manages day-to-day site operations, will be responsible for seeing that these practices are followed.

Sanitary Waste:

All sanitary sewage generated on-site will be collected from the portable units a minimum of twice per week or as required by local regulations. Units will have a berm placed around them to ensure no spillage can occur.

3.2 Off-Site Vehicle Tracking:

Traffic will be maintained on paved roadway throughout construction in order to reduce vehicle tracking of sediments. The paved street beyond the start and end of the project will be swept as often as necessary to remove any excess mud, dirt, or rock that may be tracked from the site by construction vehicles, but not less than once per week. Dump trucks hauling material to or from the construction site will be covered with tarpaulin before leaving the site.

4 DEMONSTRATION OF COMPLIANCE WITH FEDERAL, STATE, AND LOCAL REGULATIONS

The following Federal, State, and City regulations are followed in the preparation of this storm water pollution prevention plan:

- Section 402(p) of the Clean Water Act.
- Amended Section 405 of the Water Quality Act.
- “ADEQ Arizona Pollutant Discharge Elimination System General Permit for Discharge from Construction Activities to Waters of the United States, Permit AZG-2008-001.”
- Flood Control District of Maricopa County "Drainage Design Manual for Maricopa County, Arizona, Volume III, Erosion Control."
- City of Phoenix Code 32C, "Storm Water Quality Protection."
- City of Phoenix "Grading and Drainage Ordinance for Purpose of Fulfilling NPDES Requirements."

5 MAINTENANCE/INSPECTION PROCEDURES

5.1 Erosion and Sediment Control Practices:

The following is a list of erosion and sediment controls to be used during the construction period:

5.1.a Stabilization practices for this site include:

- Permanent planting.
- Save selected existing trees.
- Decomposed granite.
- CONTRACTOR TO ADD/DELETE AS NECESSARY

5.1.b Structural practices for this site will include:

- Silt fence/straw bale barriers.
- Temporary diversion dike/gravel filter berm.
- Sandbag berm.
- Storm drain, curb and gutter, catch basins.
- Temporary catch basin inlet protection.
- Temporary retention in subgrade excavation areas.
- CONTRACTOR TO ADD/DELETE AS NECESSARY

5.2 Erosion and Sediment Control Maintenance and Inspection Practice:

Following is a list of the inspection and maintenance practices that will be used to maintain erosion and sediment control:

- All control measures will be inspected at least once every 7 days and within 24 hours after each rain event of 0.1 inch or greater.
- All measures will be maintained in good working order; if repair is necessary, it will be initiated within 24 hours of report. All changes will be completed within 14 days after an observation.
- Built-up sediment will be removed from silt fence when it has reduced the design capacity by 50%.
- Erosion control fabric and erosion control dikes will be inspected and any breaches promptly repaired.
- Permanent planting will be inspected for washout and healthy growth per specification requirements.
- A Compliance Evaluation Report will be made at each inspection to ensure all BMP’s are functioning correctly.
- The site superintendent will be responsible for inspection, maintenance, and repair activities, and filling out the Compliance Evaluation Report.
- Personnel selected for inspection and maintenance responsibility will receive training from the site superintendent. They will be trained in all the inspection and maintenance practices necessary for keeping the erosion and sediment controls used on-site in good working order.
- Only one side of roadways will be excavated for subgrade preparation at a time. This area will serve as temporary retention while traffic is maintained on the paved other half of the road. This will serve to control storm water and minimize tracking of sediments.

6 INVENTORY FOR POLLUTION PREVENTION PLAN (CONTRACTOR TO EDIT AS NECESSARY)

The materials or substances listed below are expected to be present on-site during construction:

- Concrete
- Asphalitic Concrete
- Fertilizers
- Petroleum-Based Products
- Cleaning Solvents/Agents
- Sealants
- Wood
- Paints
- Herbicide/Pesticide
- Soil Treatment Products
- Other Building Materials
- Water Used in Dust Control

6.1 Spill Prevention
The following are the material management practices that will be used to reduce the risk of spills or other accidental exposure of materials and substances to storm water runoff:

6.1.a Good Housekeeping:

The following good housekeeping practices will be followed on-site during the construction period:

- An effort will be made to store only enough product required to do the immediate job.
- All materials stored on-site will be stored in a neat, orderly manner in their appropriate containers and, if possible, under proper cover and palletized.
- Liquid products will be placed on secondary containment pallets.
- Fuel tanks will be double walled.
- Drip pans will be used under all spigots unless on secondary containment.
- Products will be kept in their original containers with the original manufacturers' label.
- Substances will not be mixed with one another unless recommended by the manufacturer.
- Whenever possible, all of a product will be used up before disposing of the container.
- Manufacturers' recommendations for proper use and disposal will be followed.
- The site superintendent will inspect daily to ensure proper use and disposal of materials.
- Concrete washout will only be allowed in designated areas. The hardened waste will be disposed of weekly and before final inspection of the project.

6.1.b Hazardous Products:

These practices are used to reduce the risks associated with hazardous materials:

- Products will be kept in original containers unless they are not resealable.
- Original labels and material safety data sheets will be retained.
- If surplus product must be disposed of, manufacturers', or local and State recommended methods for proper disposal will be followed.
- Products will be monitored, an inventory will be conducted regularly, and documentation of all use and disposal will be maintained.

6.2 Product Specific Practices:

The following product specific practices will be followed on-site:

6.2.a Petroleum Products:

All on-site vehicles will be monitored for leaks and receive regular preventative maintenance to reduce any chance of leakage. Petroleum products will be stored in tightly-sealed containers which are clearly labeled. Any petroleum substances used on-site will be applied according to the manufacturer's recommendations. Spills and leaks from vehicles will be stopped immediately. Any leaking vehicle will have a drip pan placed under the leak until the unit is repaired. Secondary containment will be provided for all petroleum products stored onsite.

6.2.b Fertilizers, Herbicide, Pesticide, Soil Treatment:

All materials used will be applied only in the minimum amounts recommended by the manufacturer or as per specification. Once applied, materials will be worked into the soil to limit exposure to storm water.
On-site storage will be covered and palletized to limit contact with storm water. The contents of any partially-used bags or containers will be transferred to a sealable plastic bin to avoid spills.

6.2.c Paints:

All containers will be tightly sealed and stored when not required for use. Excess paint will not be discharged to the storm drain system or on the ground, but will be properly disposed of according to manufacturers’ instructions or State and local regulations.

6.2.d Concrete Trucks:

Concrete trucks will not be allowed to wash out or discharge surplus concrete or dump wash water other than in a designated wash-out area. The hardened waste will be disposed of weekly and before final inspection of the project.

6.3 Spill Prevention Practices:

In addition to the good housekeeping and material management practices discussed in the previous sections of this plan, the following practices will be followed for spill prevention and cleanup:

- Manufacturers’ recommended methods for spill cleanup will be clearly posted and site personnel will be made aware of the procedures and the location of the information and cleanup supplies.
- Materials and equipment necessary for spill cleanup will be kept in the material storage area on-site. Equipment and materials will include, but not be limited to, brooms, dust pans, mops, rags, gloves, goggles, kitty litter, sand, sawdust, and plastic and metal trash containers specifically designed for this purpose.
- All spills will be cleaned up immediately after discovery using dry cleanup methods.
- The spill area will be kept well-ventilated and personnel will wear appropriate protective clothing to prevent injury from contact with a hazardous substance.
- Spills of toxic or hazardous material will be reported to the appropriate State or local government agency, regardless of the size—ADEQ Hotline: (602) 771-4505; City of Phoenix Hazardous Spills Emergency: 911; City of Phoenix Hazardous Spills Safety Section: (602) 262-7555.
- The spill prevention plan will be adjusted to include measures to prevent this type of spill from recurring and procedures to clean up the spill if there is another one. A description of the spill, what caused it, and the cleanup measures will also be included.
- The site superintendent will be responsible for the day-to-day site operations, will be the spill prevention and cleanup coordinator. He will designate other site personnel who will receive spill prevention and cleanup training.

6.4 Documentation:

Documentation of all inspections, failed BMP’s, corrective action and training will be maintained onsite with the SWPPP at all times during the project, and will be maintained for not less than three (3) years after the project is complete.
OTHER REQUIRED CERTIFICATIONS

The Contractor will complete and submit the following certification forms to the City before construction begins:

- Permitee Certification
- Contractor Certification
- Subcontractor Certification (for all Subcontractors as necessary)
- Operator’s Compliance Evaluation Report
PERMITTEE’S CERTIFICATION

As Contractor of the 91st Avenue WWTP Sludge Solar Drying Beds project, I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

_______________________________
Company

Name: ___________________________

Title: ___________________________

Signature: _______________________

Date: ___________________________
CONTRACTOR CERTIFICATION

I certify under penalty of law that I understand the terms and condition of the General Arizona Pollutant Discharge Elimination System (AZPDES) Permit that authorizes the storm water discharges associated with industrial activities from the construction site identified as part of this certification. Further, by my signature, I understand that I am becoming a co-permittee, along with the subcontractors signing such certifications, to the general (AZPDES) Permit for the storm water discharges associated with construction activities of the 91st Avenue WWTP Sludge Solar Drying Beds project. As a co-permittee, I understand that I, and my company, are legally required under the Clean Water Act, to ensure compliance with the terms and conditions of the storm water pollution prevention plan developed under the AZPDES Permit and the terms of the AZPDES Permit.

General Contractor and Responsibility

Name: ________________________________

Title: ________________________________

Signature: ____________________________
SUBCONTRACTOR’S CERTIFICATION

I certify under penalty of law that I understand the terms and conditions of the General Arizona Pollutant Discharge Elimination System (AZPDES) Permit that authorizes the storm water discharges associated with industrial activity from the construction site identified as part of this certification. Further, by my signature, I understand that I am becoming a co-permittee, along with the owner(s) and other contractors and subcontractors signing such certifications, to the general AZPDES permit for the storm water discharges associated with construction activities of the 91st Avenue WWTP Sludge Solar Drying Beds project. As a co-permittee, I understand that I, and my company, are legally required under the Clean Water Act, to ensure compliance with the terms and conditions of the storm water pollution prevention plan developed under the AZPDES permit and the terms of the AZPDES permit.

Authorized Representative of Subcontractor: _____________________________________________

Signature: ___________________________ Date: __________________________

For (Subcontractor Name): ___________________________________________________________

Construction Activities: _____________________________________________________________

_________________________________________________________________________________

_________________________________________________________________________________

_________________________________________________________________________________

Verification of Completion and Acceptance of Subcontractor’s Work

All work to be performed by ___________________________________________________________ (Subcontractor) as part of the _________________________________ (Project) has been completed and accepted. Execution of this form absolves said subcontractor from liability for AZPDES violations which may occur subsequent to this date as a result of activities of the general contractor or other subcontractors.

Authorized Representative of Subcontractor: _____________________________________________

Signature: ___________________________ Date: __________________________

For (Subcontractor Name): ___________________________________________________________

Verified by (General Contractor): _____________________________________________________

Authorized Representative of General Contractor: _________________________________________

Signature: ___________________________ Date: __________________________
AZG-2008-001 General Permit for Construction Activities  
Operator’s Compliance Evaluation Report

This project requires inspection of storm water pollution controls (BMPs) on a choice of frequency described in the General Permit, Part IV. H. Attach sheets if more space is needed.

Project: __________________________________________________________________ Date: __________

Name & Title of Inspector: _________________________________________________________________

Qualifications of Inspector: □ Attached; or □ Shown in Sec. ______ of the SWPPP.

☐ Periodic Inspection; or ☐ Rain Event inspection
Relevant weather information: ______________________________________________________________

1. Location(s) of discharge from the site: ☐ None; or ☐ Description: __________________________________

2. Location(s) of and identification of BMPs that need to be maintained; failed to operate or proved to be inadequate: 
   ☐ None; or ☐ Description: ______________________________________________________________

3. Location(s) where additional BMPs are needed: ☐ None; or ☐ Description: _________________________

4. Corrective actions required, including changes and target dates: ☐ None; or ☐ Description: ______________

5. Identify all sources of non-storm water and the associated pollution control measures: ☐ None; or ☐ Description: __________________________________________________________________________

6. Identify material storage areas and evidence of, or potential for pollutant discharge from these areas: ☐ None; or ☐ Description: __________________________________________________________________________

7. Identify any other apparent incidents of non-compliance: □ None; or □ Description: __________________________

8. If no incidents of non-compliance are identified in items 1 through 7 above, the inspector certifies that the construction project is being operated in compliance with the SWPPP and the General Permit.

I certify under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Certifying Signature: ___________________________ Date: __________

Printed Name: ______________________________________
PROPOSAL to the City Engineer of the City of Phoenix.

In compliance with the Advertisement for Bids, by the City Engineer, the undersigned bidder:

____________________________________________________________________________________
(Print or Type Contractor Name)

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 will be in accordance with all applicable Maricopa Association of Governments’ (MAG) Uniform Standard Specifications and Uniform Standard Details, latest revision and the City of Phoenix Supplements, latest revision to the MAG Uniform Standard Specifications and Details, except as otherwise required by the project plans and specifications.

No proposal may be withdrawn for a period of 50 days after opening without consent of the Contracting Agency through the body or agent duly authorized to accept or reject the proposal except in the case of federally-assisted projects.

Understands that his proposal will be submitted with a proposal guarantee of cash, certified check, cashier’s check or surety bond for an amount not less than ten (10) percent of the amount bid, as referenced in the Call for Bids.

Agrees that upon receipt of Notice of Award, from the City of Phoenix, he will execute the contract documents within 10 calendar days.

Work will be completed within 300 calendar days, beginning with the day following the starting date specified in the Notice to Proceed. The time allowed for completion of the work includes lead time for obtaining the necessary materials and/or equipment and approvals.

The bidder will acknowledge all addenda in writing. By writing the addendum number(s) below, the bidder agrees that this proposal is computed with consideration of the specification book(s) plus any addenda.

<table>
<thead>
<tr>
<th>ADDENDUM NO.</th>
<th>DATE</th>
<th>ADDENDUM NO.</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
<tr>
<td>ITEM NO.</td>
<td>DESCRIPTION</td>
<td>UNIT</td>
<td>QUANTITY</td>
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<td>---------</td>
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<td>-----------------</td>
<td>----------</td>
</tr>
<tr>
<td>1</td>
<td>Mobilization / Demobilization</td>
<td>Lump Sum</td>
<td>1.00</td>
</tr>
<tr>
<td>2</td>
<td>Drying Bed 57 Clearing and Grubbing</td>
<td>Lump Sum</td>
<td>1.00</td>
</tr>
<tr>
<td>3</td>
<td>Drying Bed 57 Concrete Box Demolition</td>
<td>Each</td>
<td>12.00</td>
</tr>
<tr>
<td>4</td>
<td>Excess Material and Old Equipment Hauling and Disposal</td>
<td>Lump Sum</td>
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<tr>
<td>5</td>
<td>Drying Bed 57 Excavation (Including Existing Levee)</td>
<td>CY</td>
<td>55,400.00</td>
</tr>
<tr>
<td>6</td>
<td>Drying Bed 57 Fill - Screened Native (Including New Levee)</td>
<td>CY</td>
<td>18,600.00</td>
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<tr>
<td>7</td>
<td>Drying Bed 57 Engineered Fill (Including New Levee)</td>
<td>CY</td>
<td>11,500.00</td>
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<tr>
<td>8</td>
<td>Drying Bed 57 Paving (Bed Only)</td>
<td>Ton</td>
<td>19,500.00</td>
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<tr>
<td>9</td>
<td>Access Road Subbase Preparation (Including Top of Levee)</td>
<td>Square Foot</td>
<td>86,400.00</td>
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<tr>
<td>10</td>
<td>Drying Bed 57 Decant Boxes Complete, Including Concrete, Handrail and Grating, and Weir Gate</td>
<td>Each</td>
<td>4.00</td>
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<tr>
<td>11</td>
<td>12&quot; Decant Pipe, Including Materials and Installation</td>
<td>Linear Foot</td>
<td>730.00</td>
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<tr>
<td>12</td>
<td>15&quot; Decant Pipe, Including Materials and Installation</td>
<td>Linear Foot</td>
<td>1,870.00</td>
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<tr>
<td>13</td>
<td>Manholes, Including Materials and Installation</td>
<td>Each</td>
<td>11.00</td>
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<tr>
<td>14</td>
<td>Allowance for Extra Work</td>
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**BASE BID (ITEMS 1 THROUGH 14 - INCLUSIVE)**

$ ____________________

WRITTEN WORDS

PROJECT NO. WS90100098-1

91st Avenue Wastewater Treatment Plant
Sludge Solar Drying Beds
<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
<th>QUANTITY</th>
<th>UNIT PRICE</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Drying Bed 31 Clearing and Grubbing</td>
<td>Lump Sum</td>
<td>1.00</td>
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<tr>
<td>A2</td>
<td>Drying Bed 31 Concrete Box Demolition</td>
<td>Each</td>
<td>1.00</td>
<td>1.00</td>
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<tr>
<td>A3</td>
<td>Drying Bed 31 Excess Material Hauling and Disposal</td>
<td>Lump Sum</td>
<td>1.00</td>
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<td>A4</td>
<td>Drying Bed 31 Excavation</td>
<td>CY</td>
<td>8,200.00</td>
<td>8,200.00</td>
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<td>A5</td>
<td>Drying Bed 31 Fill - Screened Native</td>
<td>CY</td>
<td>2,400.00</td>
<td>2,400.00</td>
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<td>A6</td>
<td>Drying Bed 31 Engineered Fill</td>
<td>CY</td>
<td>2,600.00</td>
<td>2,600.00</td>
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<tr>
<td>A7</td>
<td>Drying Bed 31 Paving</td>
<td>Ton</td>
<td>4,300.00</td>
<td>4,300.00</td>
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<tr>
<td>A8</td>
<td>Drying Bed 31 Decant Box Complete, Including Concrete, Handrailing and Grating, and Weir Gate</td>
<td>Each</td>
<td>1.00</td>
<td>1.00</td>
<td></td>
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<tr>
<td>A9</td>
<td>Drying Bed 31 12&quot; Decant Pipe, Including Materials and Installation</td>
<td>Linear Foot</td>
<td>275.00</td>
<td>275.00</td>
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<tr>
<td>A10</td>
<td>Manholes, Including Materials and Installation</td>
<td>Each</td>
<td>1.00</td>
<td>1.00</td>
<td></td>
</tr>
</tbody>
</table>

**ALTERNATE A - Drying Bed 31 TOTAL**

$_____________________

& ____/100 DOLLARS

WRITTEN WORDS
<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
<th>QUANTITY</th>
<th>UNIT PRICE</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>Demolition of Existing Pumps, Valves and Piping</td>
<td>Lump Sum</td>
<td>1.00</td>
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<tr>
<td>B2</td>
<td>15 HP Pump, Installed</td>
<td>Each</td>
<td>1.00</td>
<td></td>
<td></td>
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<tr>
<td>B3</td>
<td>3 HP Pumps, Installed</td>
<td>Each</td>
<td>2.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B4</td>
<td>Sump Pumps, Installed</td>
<td>Each</td>
<td>2.00</td>
<td></td>
<td></td>
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<tr>
<td>B5</td>
<td>12-inch Diameter DIP Above Grade</td>
<td>Linear Foot</td>
<td>50.00</td>
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<tr>
<td>B6</td>
<td>Two (2) New 12-inch Connections to 72&quot; SRO</td>
<td>Lump Sum</td>
<td>1.00</td>
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<tr>
<td>B7</td>
<td>New Exhaust Fan</td>
<td>Each</td>
<td>1.00</td>
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<tr>
<td>B8</td>
<td>3-inch Diameter DIP in Drywell</td>
<td>Linear Foot</td>
<td>16.00</td>
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<tr>
<td>B9</td>
<td>4-inch Diameter DIP in Drywell</td>
<td>Linear Foot</td>
<td>12.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B10</td>
<td>6-inch Diameter DIP in Drywell</td>
<td>Linear Foot</td>
<td>16.00</td>
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<tr>
<td>B11</td>
<td>Reclaimed Water Piping for Flush Water</td>
<td>Lump Sum</td>
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<td>B12</td>
<td>3-inch Diameter Plug Valves</td>
<td>Each</td>
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<tr>
<td>B13</td>
<td>4-inch Diameter Plug Valves</td>
<td>Each</td>
<td>2.00</td>
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<tr>
<td>B14</td>
<td>6-inch Diameter Plug Valves</td>
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<tr>
<td>B15</td>
<td>12-inch Diameter Plug Valves</td>
<td>Each</td>
<td>5.00</td>
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<tr>
<td>B16</td>
<td>3-inch Check Valve</td>
<td>Each</td>
<td>2.00</td>
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<tr>
<td>B17</td>
<td>6-inch Check Valve</td>
<td>Each</td>
<td>1.00</td>
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<tr>
<td>B18</td>
<td>Paint Electrical Building</td>
<td>Lump Sum</td>
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<tr>
<td>B19</td>
<td>12&quot; Flowmeter, Installed</td>
<td>Each</td>
<td>1.00</td>
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<tr>
<td>B20</td>
<td>Electrical and Instrumentation Components, Installed</td>
<td>Lump Sum</td>
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**ALTERNATE B - Decant Pump Station No. 2 TOTAL**

$________________________

& ____/100 DOLLARS

WRITTEN WORDS
### ALTERNATE C - Access Roads

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
<th>QUANTITY</th>
<th>UNIT PRICE</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>Access Road Paving (Including Top of Levee)</td>
<td>Ton</td>
<td>4,100.00</td>
<td></td>
<td>$</td>
</tr>
</tbody>
</table>

ALTERNATE C - Access Roads TOTAL

$ ____________________

& ____/100 DOLLARS

WRITTEN WORDS

### ALTERNATE D - Access Roads Fill (if Alternate C is not selected)

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
<th>QUANTITY</th>
<th>UNIT PRICE</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>Access Roads Engineered Fill in Lieu of 7.5&quot; AC Pavement</td>
<td>CY</td>
<td>2,000.00</td>
<td></td>
<td>$</td>
</tr>
</tbody>
</table>

ALTERNATE D - Access Roads Fill TOTAL

$ ____________________

& ____/100 DOLLARS

WRITTEN WORDS
PROJECT TITLE: 91st Avenue WWTP
Sludge Solar Drying Beds
PROJECT NO.: WS90100098-1

THIS PROPOSAL IS SUBMITTED BY

a corporation organized under the laws of the State of

a partnership consisting of

a joint venture consisting of

or individual trading as

of the City of

FIRM

ADDRESS

CITY STATE ZIP CODE

PHONE VENDOR NO.

BY

Officer and Title (signature)

Officer and Title (print or type)

Date

WITNESS: If Contractor is an individual

(signature)

ATTEST: If Contractor is Corporation or Partnership

(signature and title)
SURETY BOND

Project No.: WS90100098-1

That we, ____________________________________________, as Principal, (hereinafter called the Principal) and the ____________________________, a corporation duly organized under the laws of the State of ____________________, as Surety, (hereinafter called the Surety) are held and firmly bound unto the City of Phoenix as Obligee, in the sum of ten (10) percent of the total amount of the bid of Principal, submitted by him to the City of Phoenix for the work described below, for the payment of which sum, well and truly to be made, the said Principal and the said Surety, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents and in conformance with A.R.S. #34-201.

WHEREAS, the said Principal is herewith submitting its proposal for (91st Avenue WWTP Sludge Solar Drying Beds)______________________________

NOW, THEREFORE, if the City of Phoenix will accept the proposal of the Principal and the Principal will enter into a contract with the City of Phoenix in accordance with the terms of such proposal and give such Bonds and Certificates of Insurance as specified in the Standard Specifications with good and sufficient Surety for the faithful performance of such contract and for the prompt payment of labor and material furnished in the prosecution thereof, or in the event of the failure of the Principal to enter into such contract and give such Bonds and Certificates of Insurance, if the Principal will pay to the City of Phoenix the difference not to exceed the penalty of the bond between the amount specified in the proposal and such larger amount for which the Obligee may in good faith contract with another party to perform the work covered by the proposal, then this obligation will be null and void, otherwise to remain in full force and effect.

Signed and sealed this _______ day of _______________________________________ A.D., 2018

__________________________________________  
Principal

__________________________________________  
Title

__________________________________________  
Mailing Address

__________________________________________  
Surety

WITNESS:

__________________________________________  

A.M. BEST RATING:
The City of Phoenix Small Business Enterprise Program (SBE) is managed and administered by the Equal Opportunity Department, Contract Compliance Division. Phoenix is one of the fastest growing, multicultural cities in the country and has shown a historical commitment to business diversity. The City strives to advance the economic growth of businesses through its Small Business Enterprise (SBE) Program.

Through a coordinated effort among several city departments, the SBE Program provides SBE certification, procurement opportunities, construction subcontracting utilization, small business management and technical assistance and educational services and networking opportunities.

The Small Business Enterprise (SBE) participation goal for this project is as follows:

**SBE Required Goal = 2%**

An annual SBE subcontracting participation goal has been established under this Contract. The Prime Contractor is required to demonstrate good faith efforts to utilize certified SBE firms to achieve this goal during the life of this contract.

For purposes of determining the Contractor’s actual SBE utilization during and at the end of the project, the Contractor shall meet or exceed their Proposed SBE Goal Percentage (as indicated on the Submitter’s received SBE Utilization Form with their bid submittal) for the contract, for **ALL** work performed on the project, including any amount paid for contingencies and allowances, and selected alternates. The Proposed Goal shall meet/or exceed the Required Goal.

For purposes of calculating the Contractor’s “Proposed SBE Goal Percentage” on the Contractor’s Statement of Proposed SBE Utilization form, bidders must not propose SBE subcontractors from areas identified on the bid form as contingencies and allowances or proposed alternates. Any SBE participation proposed from these areas will be not counted towards meeting the SBE goal requirement necessary for contract award.

The “Total Bid” shall be defined as the total of all the unit prices, or the lump sum total, including alternates and contingencies and allowances. The “Base Bid” shall be defined as the “Total Bid” minus “all proposed alternates” as determined by the project manager. Any additional dollars paid under this contract, including any selected alternate(s), shall be subject to the Proposed SBE Goal Percentage listed on the Contractor’s Statement of Proposed SBE Utilization form.
SBE PROGRAM DEFINITIONS

**Broker, Packager, Manufacturers’ Representative, or Jobber** means a firm that is not a manufacturer or regular dealer as defined herein.

**Commercially Useful Function (CUF)** means that a SBE firm is responsible for execution of the work of the contract and is carrying out its responsibilities by actually performing, managing, and supervising the work involved. A SBE must perform at least 75% of the total cost of its contract with its own work force in order to be determined to be performing a CUF on the contract.

**Contract** is a written agreement obligating the seller or business enterprise to furnish goods or services as submitted and the Purchaser or Buyer to pay for such goods or services.

**Contractor** is an individual, partnership, joint venture, corporation or firm that executes a contract with the City to perform services requested by a solicitation or procurement. The Contractor may be direct or through an authorized representative.

**Joint Venture (JV)** is an association between two or more persons, partnerships, corporations, or any combination thereof, formed to carry on a single business activity. The JV is limited in scope and duration to this contract. The resources, assets and labor of the participants must be combined in an effort to accrue profit.

**Manufacturer** means a firm that operates or maintains a factory or establishment that produces, on the premises, the materials, supplies, articles, or equipment required under the contract.

**Purchaser** for purposes of this contract means the City.

**Regular Dealer or Supplier** means a business that owns, operates, or maintains a store, warehouse, or other establishment in which the materials, supplies, articles or equipment of the general character described by the specifications are bought, kept in stock, and regularly sold or leased to the public in the usual course of business. The firm must be an established, regular business that engages, as its principal business and under its own name, in the purchase and sale or lease of the products in question.

**Small Business Enterprise (SBE)** means a small business that has been determined to meet the requirements for SBE certification with the City of Phoenix and whose certification is in force at the time of the award of business by the City. A directory of currently certified SBE firm is located at https://phoenix.diversitycompliance.com.

**Subcontract** a contract at any tier below the prime contract, including purchase orders.

**Subcontractor** is an individual, partnership, joint venture, corporation or firm that holds a contract at any tier below the prime contract, including purchase orders.

**Successful Submitter** is a Submitter who has been selected to perform services requested by a solicitation or procurement.
SECTION I. SBE CERTIFIED FIRMS

Only firms certified by the City of Phoenix under Chapter 18, Article VIII of the Phoenix city code are eligible to fulfill the participation goal stated above. A firm’s **certification must be in the trade areas listed on the proposed utilization form and current and in force at the date and time of the bid opening deadline.**

The most current electronic directory of all certified SBE firms can be accessed at: [https://phoenix.diversitycompliance.com](https://phoenix.diversitycompliance.com)

If you need to verify certification status, please contact the Equal Opportunity Department at (602) 262-6790 and identify yourself as a prime contractor bidding on this project. Prime contractors should verify that the certifications of the SBE firms are current prior to bid opening. **If a firm’s certification expires and is not renewed prior to the bid-opening deadline, that firm will be ineligible to satisfy the goal.**

SECTION II. SBE BID PROCEDURES

The bid envelope shall contain all information and documents related to the SBE requirements of this section. **Failure to properly complete the “Contractor’s Statement of Proposed SBE Utilization” and “Letter of Intent to Perform as a Subcontractor/Supplier” forms, or submit a fully documented waiver request as described below, will result in bid rejection.** The required documentation includes:

1. **A Contractor’s Statement of Proposed SBE Utilization** - The form shall document the name of each SBE firm that will be awarded a subcontract; services to be performed by each subcontractor; dollar amount to be paid for those services; and the total dollar amount that is being proposed in SBE participation.

2. **A Letter of Intent to Perform as a SBE Subcontractor/Supplier** (required for each SBE subcontractor/supplier proposed) The form shall be completed by the SBE firm that will be awarded the subcontract. The form documents services to be performed by the subcontractor/supplier and the total dollar amount of the subcontract that will be awarded to the SBE. Only the services performed in the area(s) described by the SBE’s certification description can be counted towards the SBE goal requirement.

The bidder’s proposed utilization of SBE firms to fulfill the participation goal must be submitted on the “Contractor’s Statement of Proposed SBE Utilization” form included in the specification packet. Additionally, each of the SBE subcontractors/suppliers the bidder is proposing to use to meet the goal requirement on this contract must complete the “Letter of Intent to Perform as an SBE Subcontractor/Supplier” (LOI) form. Both forms must be completed and submitted as part of the bid packet by the bid-opening deadline.
Small Business Enterprise Program

Failure to submit a completed “Contractor’s Statement of Proposed SBE Utilization” and signed “Letter of Intent to Perform as an SBE Subcontractor/Supplier” form for each of the proposed SBE firms will result in a bidder being declared non-responsive to the requirements of these specifications and the bid will not be considered. The forms must contain the following:

1. The Certified SBE firm name and the certified trade or services to be performed.
2. The dollar amount of the proposed subcontract to be awarded to each SBE firm.
3. The total dollar amount of all SBE proposed subcontracts.

In instances where an exact dollar amount to be subcontracted with a SBE firm cannot be determined, the bidder shall indicate on Columns 3 and 4 of Part B Section 1 of the “Letter of Intent To Perform as a SBE Subcontractor/Supplier” form the minimum guaranteed hours/units and dollar amount that will be paid to the SBE firm. This situation applies only when a Contractor proposes to utilize a SBE firm that engages in work related to a broker, supplier or; a bid that is based on a per hour charge as in hauling/trucking or construction site security. Please note that this exception does not permit the Prime contractor to complete or modify any other part of the LOI document. Both, the SBE and the bidder must sign the LOI document prior to bid submittal. By signing the document, the bidder affirms that it has not altered or modified the document in any way other than, if applicable, entering the Unit/Hours and Total Quote Amount in Part B SECTION 1.

If a bidder proposes to utilize a firm not certified by the City of Phoenix and/or not certified in the proposed scope of work at the time of bid, the proposed utilization amount for that firm will be deducted from the total proposed SBE utilization amount used for determining if the bidder is responsive to the requirements of this section. Bidder shall not include any amount the SBE firm has indicated in the LOI document as work it will sublet or is not covered in their certification description in the Contractor’s Statement of Proposed SBE Utilization form. Only amounts associated with the work to be performed by the SBE, and indicated in the SBE’s certification description, may be counted towards the SBE participation goal requirement of this section.

If the reduced proposed SBE utilization is insufficient to meet the established participation goal required for this contract, and no waiver documentation has been submitted, the bidder shall be determined to be non-responsive to the requirements of this section and the bid will not be considered.

A certified SBE firm bidding as a Prime Contractor cannot count the work it will self-perform towards meeting the required SBE subcontracting goal.

A “Letter of Intent to Perform as a Subcontractor/Supplier” will be used in determining compliance with the requirements of this section. The proposed subcontract dollar amount listed for each SBE firm on the “Contractor’s Statement of Proposed SBE Utilization” must match the SBE dollar amount indicated in the boxed areas in Parts C, D or E of the signed “Letter of Intent to Perform as a Subcontractor/Supplier.” Failure to submit a completed LOI document with the SBE’s and bidder’s signatures shall be
determined to be non-responsive to the requirements of this section and the bid will not be considered.

SECTION III. IF THE BIDDER IS UNABLE TO MEET THE GOAL

A fully documented waiver request detailing why the bidder has been unable to meet the SBE utilization goal in whole, or in part, and the “good faith” effort of the bidder to obtain SBE participation. In order to be viewed as good faith efforts, a bidder’s activities must be consistent with all activities that could reasonably be expected from a bidder who was actively and aggressively seeking to meet the SBE goal. To show proof of having exercised good faith efforts in trying to obtain bids from SBE firms to meet the utilization goals. The following factors are illustrative of those matters that shall be considered when judging whether the bidder made “good faith efforts”.

1. A cover letter addressed to the Street Transportation Procurement Section clearly indicating whether a full or partial waiver is being requested, the percentage to be waived, and the reasons the waiver is being sought.
2. If a partial waiver is being requested, a Bidder’s Statement of Proposed Utilization listing firms that will satisfy the portion of the goal that will be met must be included with the bid proposal. Additionally, a Letter of Intent to Perform as a Subcontractor/Supplier from each SBE firm that is proposed to be utilized must be included with the bid proposal.
3. Proof of contact with SBE firms, including but not limited to, fax logs, telephone logs, mail receipts, etc, including documentation of the number of times that firms were contacted, the dates of contact, and the name, phone number, fax number, and address of the contact person associated with each SBE firm. Solicitation of SBE subcontractors must be consistent with the solicitation of all subcontractors and must clearly demonstrate that SBE firms had sufficient time to submit an effective response.
4. Copies of the documents submitted to all subcontractors requesting their bid. This should include the scope of work to be bid and performed on the project.
5. Copies of bid responses/quotes from all subcontractors who bid to perform work on the project in the areas that SBE firms were also bidding on, including information as to why SBE bids were not considered.
6. Documentation that shows efforts made to provide assistance to SBE firms in the areas of bonding, insurance, or other contracting requirements.
7. Documentation of attendance at the pre-bid conference held for the project.
8. Documentation of contact made with City personnel seeking assistance in identifying eligible SBE firms for contracting opportunities on the project.

SECTION IV. SBE WAIVER PROCEDURES

Requests for a partial or full waiver of the SBE goal for the project including all Good Faith Documentation shall be submitted as part of the bid packet. The request will be reviewed to ensure compliance with the requirements of this section. If the request is determined to meet the requirements, a waiver hearing will be scheduled and the bidder notified of the
date, time, and place of the hearing. All waiver hearings are open to the public. However, only the designated representative for the contractor and City staff may participate in the proceedings.

The contractor requesting the waiver may appear at the hearing to present their request and answer questions from the Waiver Review Committee regarding their submittal. The Committee will consider the information and documentation that was submitted at the time of bid. The bidder may not present additional or new information at the hearing. At the conclusion of the hearing process the Committee will make independent recommendations on the request for waiver. The presiding officer, on behalf of the Committee, will provide a written summary of the Committee’s recommendations to the City Manager’s designee, the City Engineer. The City Engineer will make the final decision to grant or deny the waiver request. The City Engineer’s decisions shall be final. The City will notify the contractor regarding the final decision of the City Engineer.

If a partial or full waiver of the SBE goal is granted to a bidder, the bidder shall be considered to have met the project goals and their bid will be considered responsive to the requirements of this section. If a waiver is denied, the bidder is deemed non-compliant and non-responsive to the requirements of this section and their bid will not be considered.

Failure to submit the Contractor’s Statement of Proposed SBE Utilization form and a LOI from each SBE firm proposed OR a fully documented waiver request at the time of bid will be cause to determine the bidder non-responsive to the requirements of this section.
SECTION V. LIMITATION OF THE USE OF SUPPLIERS AND BROKERS TO FULFILL THE SBE GOAL

Proposed expenditures to brokers and suppliers can be used to meet the utilization goal, provided that the combined applicable expenditures do not exceed 25 percent (25%) of the total SBE goal requirement. Contractors may count one hundred percent (100%) of the dollars proposed to be paid to a SBE supplier, and all costs associated with fees and commission to be paid to a SBE broker, up to the 25% limitation.

Supplier (or Wholesaler) is defined as firm that does not directly manufacture the product being supplied and has an established, regular business that engages, as its principal business and under its own name, in the purchase and sale or lease of the products in question. A supplier is a firm that owns, operates, or maintains a store, warehouse, or other establishment in which the materials, supplies, articles or equipment of the general character described by the specifications and required under the contract are bought, kept in stock, and regularly sold or leased to the public in the usual course of business.

EXAMPLE: An SBE goal of 5% has been established on a project where the contractor has submitted a base bid of $1,000,000. This results in a dollar goal of $50,000 to be subcontracted to SBE’s. The contractor proposes to contract with a SBE supplier for $100,000. Only $12,500, or 25 percent (25%), may be counted towards achievement of the SBE goal for this project. The remaining $37,500 must be achieved through the use of firms that are not suppliers or brokers.

Broker is defined as firm that arranges or expedites services or transactions through the use of individuals not directly employed by the company. Brokers are not regular suppliers. Only costs associated with the fees and commission paid to the certified firm for providing such services may be applied towards the SBE contract goal.

The following defines the expenditures to SBE firms that are NOT subject to the 25% limitation. The following expenditures may be counted in their entirety towards fulfilling 100% of the utilization goal:

1. Expenditures to certified SBE firms that operate and maintain an establishment or factory to produce, on the premises, the materials or supplies purchased for the contract.
2. Expenditures to a certified SBE fabricator that operates and maintains a factory to substantially alter materials or supplies before resale.
3. Expenditures, including fees and commissions, charged to provide bona fide technical and professional personnel recruitment for the contract. The total cost paid that shall be comparable to the industry standards customarily charged for the same or similar services.
4. Expenditures, including fees and commissions, charged for providing bonds and insurance specifically required for the performance of the contract. The total cost shall be comparable to the industry standards charged for the same or similar services.
All SBE firms proposed to participate on this contract opportunity must be SBE certified by the City of Phoenix prior to the date and time of the bid.

Participation on the contract will be calculated based on that portion (dollar value) of the contract that the SBE actually performs with its own forces. This includes the cost of supplies and materials obtained by the SBE for the work on the contract, except in cases when; it has been determined by the City not to be part of the firm’s certification description; the SBE is certified as a "placer", “finisher”, or “installer” of those materials only, or when the supplies and/or equipment it uses to perform its work is purchased or leased from the Contractor or its affiliate.

*Special emphasis and care should be taken to ensure that the following types of participation are handled properly when preparing your bid packet, as failure to correctly calculate the allowable SBE participation in the following areas shall result in your bid being declared non-responsive if the SBE goal requirement is not met:*

**Fees & Commissions:** SBE firms that supply a bona fide service for a fee or commission may be counted only to the extent of the fees or commissions charged by the SBE. This includes, but is not limited to, providing professional, technical, consultant, or managerial services, and bonds or insurance specifically required for the performance of a contract. Fees must be reasonable, not excessive, compared to fees customary for similar services.

*EXAMPLE:* A SBE firm that supplies uniformed officers for security or traffic control may count only the amounts charged as a commission. The hourly amount paid to the officers may not be counted. If the “per hour” bid amount to the prime contractor is $35, and $25 per hour will be paid to the officers, only $10 per hour can be counted towards achieving the SBE goal. If the firm or bidder estimates that there will be 200 hours of work bid at a rate of $35 per hour, only $2,000 of the total $7,000 bid could be counted.

**Trucking & Hauling:** The amount of a trucking/hauling subcontract that may be counted towards the utilization requirements may be limited. An SBE must itself own and operate at least one fully licensed, insured, and operational truck that will be used on the contract. In addition, trucks the SBE leases without drivers under a long-term leasing agreement may be considered part of the trucking firm’s workforce and counted in full, provided the leasing agreement(s) is/are for a period of not less than 6 months and; the *leased vehicles have been recorded with the City’s Equal Opportunity Department’s Certification Office prior to the submittal of the LOI document.*

*EXAMPLE:* A SBE trucking firm uses seven trucks on a job; two are owned by the SBE and five are leased from other firms. If two of the five trucks are leased without drivers and the remaining three are leased with drivers from another firm, then the amount paid to the SBE for the services provided by the trucks it owns and the two it leases without drivers and operates with its own employees can be counted in full towards meeting the SBE requirements. The Contractor may not count any portion of the amount the SBE receives for the two trucks it leases with drivers towards the SBE utilization goal.
SECTION VI. POST AWARD SBE COMPLIANCE INFORMATION - DBB

Submittal of a bid to the City of Phoenix shall constitute an agreement by the bidder to comply with the SBE utilization requirements of this section should the bidder be awarded a contract. This includes, but is not limited to, the following compliance activities:

1. The contractor shall contract, or attempt to contract, in good faith with all SBE firms listed on the Bidder’s Statement of Proposed SBE Utilization form submitted with their bid. The subcontract shall be for an amount that is equal to, or greater than, the total proposed dollar amount listed on the form, with the exception of instances where the City changes a scope of work in the contract that would reduce the available work in the subcontractor’s area of performance.

2. The contractor shall not reduce any of the proposed SBE scopes of work or amounts indicated on the Bidder’s Statement of Proposed SBE Utilization form without first submitting a Request for Exemption and receiving approval in writing from the City’s Equal Opportunity Department (EOD), Contract Compliance Division.

3. The contractor shall notify the City of Phoenix Equal Opportunity Department immediately if any firm listed on the Bidder’s Statement of Proposed SBE Utilization form refuses to enter into a subcontract or fails to perform according to the requirements of the subcontract.

4. Any reduction of retention by the City to the contractor shall result in a corresponding reduction to subcontractors or suppliers who have performed satisfactory work. The contractor has 14 days from the date their retention reduction takes affect to reduce retention to the subcontractors.

5. The contractor shall return all retention monies to subcontractors at such time as the work originally proposed by the subcontractor, and expressed in the original subcontract agreement, is complete and the purchaser (City) has accepted the work and paid the prime for the work performed by the subcontractor. Retention shall be paid no later than 30 days after such payment is made by the City.

6. The contractor shall act in good faith to meet the contract SBE utilization goal and provide all necessary documentation to show proof of those efforts as requested by the City.

If for any reason the SBE firm is decertified prior to the execution of a subcontract agreement, the bidder shall find additional SBE participation in the amount equivalent to or greater than that which was originally proposed for the SBE firm. Bidder shall make every good faith effort possible in finding a SBE replacement in the proposed trade area first, before considering SBE participation in other trade areas.
Small Business Enterprise Program

SECTION VII. Subcontract Assurances

Each contract signed by the Agency and the Successful Bidder and each subcontract signed by the Successful Bidder with a Subcontractor, including Subcontractors with lower tier Subcontractors must include the following assurances verbatim:

**Prompt Payment of Subcontractors** The Contractor and Subcontractor shall promptly pay its lower tier subcontractors, sub consultants, or suppliers upon receipt of payment from the City of Phoenix (Agency).

Progress Payments: In accordance with the Arizona Revised Statues (ARS), Section 34-221(G), the Contractor(s) shall promptly pay its subcontractors, sub consultants, or suppliers within seven (7) calendar days of receipt of each progress payment from the Agency. Any diversion by the Contractor(s) of payments received for work performed on the contract, or failure to reasonably account for the application or use of such payments, constitutes grounds for a declaration of breach of the contract with the Agency.

Retention Payments: If the Agency reduces the Contractor’s retention, the Contractor shall correspondingly, within 14 days, reduce the retentions held against the Subcontractors and suppliers that have performed satisfactory work.

Release of Retention: The Contractor(s) shall ensure prompt and full payment of retentions to Subcontractors and suppliers when their work is complete, the Agency has accepted the work, and the Agency has paid the Contractor for the work. The Contractor shall pay each Subcontractor’s and supplier’s retention no later than 30 days after the Agency pays Contractor for the completed scope of work.

**Changes to Subcontracts and Values** The City of Phoenix prohibits Contractor(s) from altering the Contractor’s Statement of Proposed SBE Utilization form without receiving prior, written consent from the City. The Equal Opportunity Department must be informed, in writing, and in advance of the following:

- Reduction to the scope of work performed by subcontractors working on the contract
- Changes in any of the subcontract values resulting in a reduced dollar amount
- Replacement and/or release of any subcontractor after contract award

Contractor(s) and Subcontractor(s) are required to complete a Request for Exemption Form and have the written approval of the Contract Compliance Office prior to taking action on any of the above listed matters related to SBE subcontractors.

In the event that any provision of this subcontract varies from the provisions of the contract or subcontract, the provisions for SBE contract compliance as contained in Administrative Regulation 1.89, Section IX, shall provide definitive guidance.

**Disclaimer:** Nothing in this section prevents the Contractor or Subcontractor from enforcing its subcontract with a lower tier Subcontractor or supplier for defective work, late performance, and other claims arising under the Subcontract.
SECTION VIII. RECORDS and REPORTING REQUIREMENTS

1. Records
   During performance of the Contract, the Successful Submitter shall keep all records necessary to document DBE and Small Business participation. The Successful Submitter shall provide the records to the Agency within 72 hours of the Agency’s request and at final completion of the Contract. The Agency will prescribe the form, manner, and content of reports. The required records may include but not limited to:

   a) A complete listing of all Subcontractors and suppliers on the project;
   b) Each Subcontractor’s and supplier’s scope performed;
   c) The dollar value of all subcontracting work, services, and procurement;
   d) Copies of all executed Subcontracts, purchase orders, and invoices: and
   e) Copies of all payment documentation.

2. Reports
   a. The contractor shall participate in all compliance reviews determined necessary by the City. This includes, but is not limited to participating in on-site reviews, providing monthly utilization reports of SBE activity, providing signed copies of subcontracts and/or purchase orders with each SBE listed on the Bidder’s Statement of Proposed SBE Utilization form, and complying with any and all requests for information the City deems appropriate for effectively monitoring this contract for compliance with the SBE Program requirements.

   b. The contractor shall provide regular, monthly report/audit information that will assist us in effectively monitoring your compliance with the SBE Program requirements. This shall include listing all subcontractors working on the contract and reporting payments into the Certification and Compliance System [https://phoenix.diversitycompliance.com](https://phoenix.diversitycompliance.com). Reporting audits shall include all payments received from the City and payments you have issued to all subcontractors and suppliers. Copies of the first 2 pages of the Pay Request submittal are required with each report. All Monthly audit reports are to be completed online by the 15th of every month. ([https://phoenix.diversitycompliance.com](https://phoenix.diversitycompliance.com)).

      i. The total of all payments received from the City during the previous month.
      ii. The first two pages of each payment application submitted for those payments.
      iii. All payments made to Subcontractors during the previous month.

Before the Agency processes the Successful Submitter’s final payment and/or outstanding retention held against the Successful Submitter, the Successful Submitter shall submit to the Agency a final certification of full and final payment to each Subcontractor in the form prescribed by the Agency. The form must be completed and certified by the Successful Submitter’s and each Subcontractor’s duly authorized agents.
SECTION IX. PERFORMANCE OF A COMMERCIALY USEFUL FUNCTION

The prime contractor may count only expenditures to SBE subcontractors that perform a commercially useful function in the work of the contract, as defined in Chapter 18 Article VI of the City Code. A "commercially useful function" constitutes performing real and actual services related to the contract.

SBE subcontractors may enter into second-tier subcontracts consistent with normal industry practices. If an SBE subcontracts greater than twenty-five (25) percent of the work of their contract, the SBE subcontractor shall be presumed not to be performing a commercially useful function. In this event, the prime contractor will not be allowed to claim any expenditure to the SBE subcontractor.

SECTION X. FAILURE TO COMPLY WITH THE SBE PROGRAM REQUIREMENTS

If the Equal Opportunity Department determines that the contractor will fail, or has failed, to meet the SBE subcontracting goals, and/or has failed to act in good faith to ensure compliance with the SBE conditions of its contract; it shall deem the contractor "noncompliant" and not in good standing. A noncompliant status shall result in the rejection of all future contract bids or offers for all projects or other procurements with the City until such time that the contractor has cured its breaches and demonstrates that it has faithfully performed its approved SBE utilization plan and all other provisions of this article required to be deemed in good standing. In addition to this action, the City may also exercise its option to impose any or all of the following remedies:

1. Withholding from the contractor ten percent (10%) of all future payments on the involved eligible project until it is determined that the contractor is in compliance;

2. Withholding from the contractor all future payments on the involved project until it is determined that the contractor is in compliance

Failure to cure a non-compliance status within the time frame provided by the City may result in further action, including but not limited to imposing any or all of the following sanctions:

1. Rejection of all future bids or offers from the contractor for any eligible project with the City or any of its departments or divisions for a period of (1) year after substantial completion of the contract.

2. Cancellation of the contract.
CONTRACTOR’S STATEMENT OF PROPOSED SBE UTILIZATION (DBB)

PROJECT NUMBER/NAME: WS9010098-1 / 91st Ave WWTP Sludge Solar Drying Beds

Required SBE Goal: 2%

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<th>SBE FIRMS</th>
<th>COMPANY NAME</th>
<th>SERVICES TO BE PROVIDED</th>
<th>SUPPLIER-YES/NO</th>
<th>SBE $$ AMOUNT from LOI Tables - Sections C, D, or E</th>
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May not satisfy more than 25% of the Goal

Total Bid - Alternates = Base Bid

($ _ _ _ _ _ _ _ _ ) ÷ ($ _ _ _ _ _ _ _ _ _ _ _ _ ) × 100 = _ _ _ _ _ _ _ _ _ _ _ _ %

Total Proposed SBE Dollars + Base Bid × 100 = Total Proposed SBE Participation %

Proposed SBE Percentage must equal to or exceed the Required SBE Required Goal Percentage. All additional contract dollars, including selected alternates, will be subject to the Proposed SBE Goal %. NO rounding allowed. Do not alter or adjust any dollar amount or percentage on this form; it may have a negative impact on your bid.

I hereby certify by signing below the foregoing SBE firms shall be contracted to work on the trades identified above and/or supply material/equipment for this project. The information shown above is a true reflection of the proposed subcontracts.

COMPANY NAME: _______________________________ EMAIL: _________________________________

PHONE: _________________________________

NAME & TITLE: _________________________________

SIGNATURE: _________________________________ DATE: _________________________________
Small Business Enterprise Program
Letter of Intent (LOI) To Perform as an SBE Subcontractor

(This form must be completed by the SBE subcontractor – both SBE subcontractor & prime signature are required)

Project Number: WS901000098-1  Project Description: 91st Ave WWTP Sludge Solar Drying Beds

TO: _______________________________________________ (Insert Name of Prime Contractor)

FROM: _______________________________________________ (Insert Name of SBE Firm)

A. The undersigned declares that the firm bidding to perform the work described herein, has been granted certification by the City of Phoenix (COP) as a Small Business Enterprise (SBE) in the area(s) of:

(COP) Certification Description:

B. The undersigned is bidding to perform the following scope(s) of work on the above referenced project:

SECTION 1 - COMPLETE THIS PORTION IF THE SCOPE OF WORK IS BEING BID BY UNIT PRICE OR HOURLY RATE

<table>
<thead>
<tr>
<th>Scope of Work</th>
<th>Unit/Hourly Rate</th>
<th># of Units/Hours</th>
<th>Total Quote Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>$</td>
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</tbody>
</table>

SECTION 2 - GENERAL OR SPECIALTY CONSTRUCTION TRADE AREAS MUST USE THIS SECTION

<table>
<thead>
<tr>
<th>Scope of Work</th>
<th>Total Quote Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$</td>
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</tbody>
</table>

C. Of the Total Quote Amount reflected in Part B - SECTION 2, the following scope(s) of work with the given amount will not be performed by the SBE or is/are not covered under the SBE’s certification description:

Scope(s) of Work ___________________________ Amount ___________________________

Subtract Amount in Part C above from the Total Quote Amount in Part B - Section 2 = * $ ___________________________

* Only this amount shall be reflected on the Bidder’s Statement of Proposed Utilization.

D. If trucking services are included in Part B - SECTION 1 above, SBE MUST complete the following:

Of the Total Quote Amount noted in part B - Section 1, the SBE affirms that the amount of * $ ___________________________

shall be performed by drivers the firm employs, and trucks the SBE owns and leases without drivers.

(The amount referenced above is transferred from Step 9 of the Worksheet (L.O.I.W. -1). *Only this amount shall be on the Statement of Proposed Utilization)

E. All subcontractors providing Broker or Traffic Control/Security Services indicated in Part B - SECTION 1 above

MUST Complete the Following:

Rate of the SBE’s fees/commissions %; for a Total Amount in fees/commissions of: $ ___________________________

The Percentage and Total Amount referenced above is transferred from Steps 2 and 3 of the Worksheet (page L.O.I. W.-1).

Only the Total Amt in fee/commissions shall be reflected on the Bidders Statement of Proposed Utilization.

Should the prime contractor receiving this form be selected for award of the contract, the undersigned affirms that he/she will enter into an agreement to perform the work bid herein.

(SBE Subcontractor Authorized Signature) _______________________________ (Date)

(Print Name and Title) _______________________________ (Phone Number)

By signing this LOI document, the Prime Contractor affirms that it has not altered or modified this document in any way other than, if applicable, entering the Unit/Hours and Total Quote Amount in Part B SECTION 1.

(Prime Contractor Authorized Signature) _______________________________ (Date)

(Print Name and Title) _______________________________ (Phone Number)
City of Phoenix
Small Business Enterprise Program

LETTER OF INTENT TO PERFORM AS A SUBCONTRACTOR/SUPPLIER
INSTRUCTIONS AND WORKSHEET - L.O.I. W.-1

A Letter of Intent to Perform as a SBE Subcontractor/Supplier (required for each SBE subcontractor/supplier proposed). The form documents services to be performed by the subcontractor/supplier and the total dollar amount of the subcontract that will be awarded to the SBE. Only the services performed in the area(s) described by the SBE’s certification description can be counted towards the SBE goal requirement.

Part I. Trucking and Hauling: SBEs should indicate on Part B-Section 1 and Part D, of the LOI form, the information regarding trucks to be used in executing the contract. The City allows the counting of all payments for services provided by trucks which the SBE owns. Trucks which the SBE leases on a long-term basis and are operated with drivers the SBE employs may also be counted in full. The payments for short-term leased trucks, with or without SBE employed drivers cannot be counted. Only trucks for which leasing agreements have been submitted and approved by EOD as part of the SBE firm’s current certification file shall be considered eligible for counting towards the goal.

<table>
<thead>
<tr>
<th>STEP ONE</th>
<th>STEP TWO</th>
<th>STEP THREE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of work expected to be performed by trucks owned by the SBE (2 Trucks)</td>
<td>Value of work expected to be performed by trucks leased (with drivers) by the SBE on a long-term basis (2 Trucks)</td>
<td>Combined value of work expected to be performed by other trucking firms and/or trucks leased (without drivers) by the SBE (3 Trucks)</td>
</tr>
<tr>
<td>$20,000</td>
<td>$20,000</td>
<td>$33,000</td>
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</tbody>
</table>

Estimated value for services provided by all trucks the SBE will use on the contract. (Add Steps One, Two, and Three)

The following information is provided as a sample only:

<table>
<thead>
<tr>
<th>STEP ONE</th>
<th>STEP TWO</th>
<th>STEP THREE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Number of Hours</td>
<td>Per Hour Bid Amount</td>
<td>Calculation Formula: Calculation Formula:</td>
</tr>
<tr>
<td>200</td>
<td>$35</td>
<td>200 x $35 = $7,000</td>
</tr>
</tbody>
</table>

Per Hour Bid Amount | Officers Hourly Rate | SBE Firm Commission/Fee | Calculation Formula: Fees/Commissions Percentage:
| $35 | $25 | $10 | (10 / 35) * 100 = 28.57% |

Gross Bid Amount (from Step One) | Commission/Fee % (from Step Two) | Calculation Formula: Amount Countable for SBE Participation:
| $7,000 | 28.57% | $7,000 x .2857 = $2,000 |

Part II. Fees and Commissions: Insert the information from below under Step Three-Commission/Fees Percentage and the Countable Amount for SBE Participation into Part E of the LOI form. This part is applicable for the use of uniformed officers to provide traffic control and security and other services provided at an hourly rate by non-employees of the SBE contractor.

Part III. Construction Trade Areas: SBE must indicate in the Scope of Work of Part B-Section 2 of the LOI form, all scope(s) of work associated with the Total Quote Amount. The SBE must complete Part C of the LOI form by entering the Scope of Work and amount not expected to be performed by the SBE or which is not covered under the SBE’s certification description. Subtracting this amount from the Total Quote Amount in Part B-Sect. 2 will result in the portion of work that can be counted as SBE participation.
# CITY OF PHOENIX
LIST OF MAJOR SUBCONTRACTORS AND SUPPLIERS

**PROJECT NO.: WS90100098-1**

**PROJECT TITLE:** 91st Avenue WWTP Sludge Solar Drying Beds

<table>
<thead>
<tr>
<th>DESCRIPTION OF WORK OR MATERIALS (CONTRACTOR TO ENTER TRADE/SUPPLIER AREAS)</th>
<th>SELF-PERFORMED BY PRIME CONTRACTOR</th>
<th>SUBCONTRACTOR/SUPPLIER COMPANY NAME (IF NOT SELF-PERFORMED)</th>
<th>CONTACT PERSON</th>
<th>PHONE NUMBER</th>
</tr>
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<tbody>
<tr>
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</table>

I hereby certify by signing below that the above listed companies will be utilized to perform work on this project for an amount **equal to or greater than 2% of the base bid.** These companies will not be removed or replaced without prior written approval by the City of Phoenix Project Manager. The City requires, as in Paragraph D – List of Major Subcontractors and Suppliers in the Information for Bidders that ALL vendors are listed or you will be disqualified. If you are self-performing the work, you must still list any suppliers for materials, or list any contractors that will assist you in any form.

**COMPANY NAME _______________________________________________________**

**SIGNATURE _________________________________________________________**

**NAME & TITLE _________________________________________________________**

**PHONE NUMBER _____________ **

**DATE ________________**

**EMAIL ADDRESS _______________________________________________________**
<table>
<thead>
<tr>
<th>DESCRIPTION OF WORK OR MATERIALS (CONTRACTOR TO ENTER TRADE/SUPPLIER AREAS)</th>
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</tbody>
</table>

I hereby certify by signing below that the above listed companies will be utilized to perform work on this project. These companies will not be removed or replaced on the project without prior written approval by the City of Phoenix Project Manager. The City requires, as in Paragraph D - List of All Subcontractors and Suppliers in the Information for Bidders that ALL vendors are listed or you will be disqualified. If you are self-performing the work, you must still list any suppliers for materials, or list any contractor’s that will assist you in any form.

COMPANY NAME _____________________________________________________ SIGNATURE ________________________________

NAME & TITLE _____________________________________________________ PHONE NUMBER _____________ DATE _____________

EMAIL ADDRESS __________________________________________

L.O.S. - 2
Authorized Contact for this Disclosure Statement

Name: ____________________________________________

Title: _____________________________________________

E-mail: ____________________________________________

Phone number: _____________________________________

FAX number: _______________________________________

List any other DBA, trade name, other identity, or EIN used in the last five (5) years, the state or country where filed, and the status (active or inactive): (if applicable):

____________________________________________________________________________________________________________________________

____________________________________________________________________________________________________________________________

____________________________________________________________________________________________________________________________

____________________________________________________________________________________________________________________________

____________________________________________________________________________________________________________________________

Business Characteristics

Business entity type – Please check appropriate box and provide additional information:

☐ Corporation Date of incorporation: ____________
☐ Limited Liability Company Date organized: ________________
☐ Limited Liability Partnership Date of registration: ________________
☐ Limited Partnership Date established: ________________
☐ General Partnership Date established: ________________
☐ Sole Proprietor How many years in business?: __________
☐ Other (explain) Date Established: ________________

Was the business entity formed in the State of Arizona? Yes_____ No_____ If no, indicate jurisdiction where Business Entity was formed: ________________________________

Is the Business Entity currently registered to do business in Arizona with the Arizona Corporation Commission? Yes_____ No_____ Not required ________ (if sole proprietor or general partnership)

Does the Business Entity have a City of Phoenix business privilege license? Yes_____ No_____ If “no” explain and provide detail such as “not required” or “application in progress” or other reason.

Is the Business Entity publicly traded? Yes_____ No_____
comprising the Joint Venture. Yes_____ No______

Is the Business Entity’s Principal Place of Business/Executive office in Phoenix? If “no” does the Business Entity maintain an office in Phoenix? Yes_____ No______

Provide the address and phone number for the Phoenix office. ________________________________________________________________

Is the business certified by Phoenix as a Small Business Enterprise? Yes_____ No______

Identify Business Entity Officials and principal Owners:

Name(s) _________________________________________Title________________________________Percentage ownership ___%(Enter 0% if not applicable).

Name(s) _________________________________________Title________________________________Percentage ownership ___%(Enter 0% if not applicable).

Name(s) _________________________________________Title________________________________Percentage ownership ___%(Enter 0% if not applicable).

Name(s) _________________________________________Title________________________________Percentage ownership ___%(Enter 0% if not applicable).

Affiliates and Joint Venture Relationships

Does the Business entity have any Affiliates? Yes_____ No_____ Attach additional pages if necessary.

Affiliate name: __________________________________________________

Affiliate EIN (if available):__________________________________________.

Affiliate’s primary Business Activity:______________________________

Explain relationship with Affiliate and indicate percent ownership, if applicable. ________________________________________________________

Are there any Business Entity Officials or Principal Owners that the Business Entity has in common with this Affiliate? ____________________________

Individual’s name:____________________________________________________

Position/Title with Affiliate:__________________________________________

Has the Business Entity participated in any joint Ventures within the past three years? Yes_____ No______

(Attach additional pages if necessary)

Joint Venture Name:__________________________________________________

Joint venture EIN (if applicable):______________________________

Identify parties to the Joint Venture:__________________________________

B.D.S.-2
Contract History

Has the Business Entity held any contracts with the city of Phoenix in the last three (3) years? Yes_____ No______ If “yes” attach a list.

Integrity – Contract Bidding

Within the past three (3) years, has the Business Entity or any Affiliate been suspended or debarred from any government contracting process or been disqualified on any government procurement? Yes_____ No____

Been subject to a denial or revocation of a government prequalification? Yes_____ No____

Been denied a contract award or had a bid rejected based upon a finding of a non-responsibility by a government entity? Yes_____ No____

Agreed to a voluntary exclusion from bidding/contracting with a government entity? Yes_____ No____

Initiated a request to withdraw a bid submitted to a government entity or made any claim of an error on a bid submitted to a government entity? Yes_____ No____

For each “Yes” answer above, provide an explanation of the issues.

Integrity – Contract Award

Within the past three (3) years has the Business Entity or any Affiliate been suspended, cancelled, or terminated for cause on any government contract? Yes_____ No____

Been subject to an administrative proceeding or civil action seeking specific performance or restitution in connection with any government contract? Yes_____ No____

For each “yes” answer, provide an explanation. (Attach explanation on a separate sheet of paper).

Certifications/Licenses

Within the past three (3) years, has the Business Entity or Affiliate had a revocation, suspension, or disbarment of any business or professional permit and/or license? Yes_____ No____

If “yes” provide an explanation of the issue(s), the Business Entity involved, the relationship to the submitting Business Entity, relevant dates, the government entity involved, and any remedial or corrective action(s) taken and the current status of the issues.
Legal Proceedings

Within the past three (3) years, has the Business Entity of any Affiliate:

Been the subject of an investigation, whether open or closed, by any government entity for a civil or criminal violation? Yes_____ No______

Been the subject of an indictment, grant of immunity, judgment or conviction, (including entering into a plea bargain for conduct constituting a crime)? Yes_____ No______

Received any OSHA citation and Notification of Penalty containing a violation classified as serious or willful? Yes_____ No______

Had a government entity find a willful prevailing wage or supplemental payment violation? Yes_____ No______

Been involved in litigation as either a plaintiff or a defendant involving a copyright or patent infringement violation or an anti-trust violation? Yes_____ No______

Other than previously disclosed, for the past three (3) years:

(i)  Been subject to the imposition of a fine or penalty in excess of $1000 imposed by any government as a result of the issuance of citation, summons or notice of violation, or pursuant to any administrative, regulatory, or judicial determination? Yes_____ No______

(ii) Been charged or convicted of a criminal offense pursuant to any administrative and/or regulatory action taken by any government entity? Yes_____ No______

If “yes” provide an explanation of the issue(s), the Business Entity involved, the relationship to the submitting Business Entity, relevant dates, the government entity involved, and any remedial or corrective action(s) taken and the current status of the issues.

Leadership Integrity

If the Business Entity is a joint Venture Entity, answer “N/A – Not Applicable” to questions below:

Within the past three (3) years has any individual previously identified, or any other Business Entity Leader not previously identified, or any individual having the authority to sign, execute, or approve bids, proposals, contracts or supporting documentation with the city of Phoenix been subject to:

A sanction imposed relative to any business or professional permit and/or license? Yes_____ No______

An investigation, whether open or closed, by any government entity for a civil or criminal violation for any business related conduct? Yes_____ No______
City of Phoenix

AFFIDAVIT OF IDENTITY

Your completion of this form is required by Arizona state law. A.R.S. §§ 1-501 and -50 only if you are a sole proprietor.

I, ________________________________________________(print full name exactly as on document), hereby affirm, upon penalty of perjury, that I presented the document marked below to the City of Phoenix, that I am lawfully present in the United States, and that I am the person stated on the document. (select one category only)

☐ Arizona driver license issued after 1996.
   Print first four numbers/letters from license: ____________________________

☐ Arizona non-operating identification license.
   Print first four numbers/letters: ____________________________

☐ Birth certificate or delayed birth certificate issued in any state, territory or possession of the U.S.
   Year of birth: ____________; Place of birth: ________________________________

☐ United States Certificate of Birth Abroad.
   Year of birth: ____________; Place of birth: ________________________________

☐ United States Passport.
   Print first four numbers/letters on Passport: ____________________________

☐ Foreign Passport with United States Visa.
   Print first four numbers/letters on Passport: ____________________________
   Print first four numbers/letters on Visa: ____________________________

☐ I-94 Form with a photograph.
   Print first four numbers on I-94: ____________________________

   Print first four numbers/letters on EAD: ____________________________
   or Perm. Resident Card (acceptable alternative): ____________________________

☐ Refugee Travel Document.
   Date of issuance: _______________; Refugee country: ____________________________

☐ U.S. Certificate of Naturalization.
   Print first four digits of CIS Reg. No.: ____________________________

☐ U.S. Certificate of Citizenship.
   Date of issuance: _______________; Place of issuance: ____________________________

☐ Tribal Certificate of Indian Blood.
   Date of issuance: _______________; Name of tribe: ____________________________

☐ Tribal or Bureau of Indian Affairs Affidavit of Birth.
   Year of birth: ____________; Place of birth: ____________________________

Signed: ____________________________  Dated: ____________________________

A.O.I.-1
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<td>16422</td>
<td>Combination Magnetic Motor Starters</td>
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</tr>
<tr>
<td>50</td>
<td>17001</td>
<td>Process Control System - General Requirements</td>
</tr>
<tr>
<td>51</td>
<td>17051</td>
<td>Process Control Descriptions</td>
</tr>
<tr>
<td>52</td>
<td>17052</td>
<td>Process Control System Primary Sensors and Field Instruments</td>
</tr>
<tr>
<td>53</td>
<td>17260</td>
<td>Control Panels</td>
</tr>
</tbody>
</table>
CITY OF PHOENIX: Water Services Department
PROJECT NAME: 91 st Avenue WWTP Sludge Solar Drying Beds
PROJECT NUMBER: WS90100098

SECTION 01110

SUMMARY OF WORK

PART 1 - GENERAL

1.1 LOCATION AND DESCRIPTION OF WORK

A. The Work is located on the site of the City of Phoenix 91 st Ave WWTP in Phoenix, Arizona.

B. The Contract Documents include the following:
   • Volume 1 of 3 Division 0
   • Volume 2 of 3 Divisions 1 Through 17 Specifications
   • Volume 3 of 3 Drawings

C. The Contract Documents for the Work to be performed include the following, but are not limited to:
   1. Demolition and clearing of area occupied by future drying bed No. 57
   2. Construction of new solar drying bed No. 57 including drying bed grading and paving.
   3. Construction of decant / drainage boxes within the new drying bed No. 57
   4. Construction of new drainage piping from drying bed No. 57 to Decant Pump Station No. 2.
   5. Bid Alternate A includes clearing and miscellaneous demolition in the area of the existing drying bed No. 31, grading and paving of drying bed No. 31, construction of new decant / drainage box, and drainage piping. Bid Alternate A items are shown on Plan Sheets C3, C4, C8 and C11.
   6. Bid Alternate B includes improvements to the existing decant pump station No. 2 including replacing the pumps, mechanical equipment, and electrical and instrumentation improvements. Bid Alternate B items are shown on Plan Sheets M1-M3; Details 7, 8 and 9 on Plan Sheet S3; Plan Sheets E1-E8; and Plan Sheets I1-I4.
   7. Bid Alternate C includes paving and grading of access road to the solar drying bed No. 57. Bid Alternate C items are shown on Plan Sheet C5 as “AC Access Road Type ‘B’ Paving Section”, Plan Sheet C7 areas referring to Detail 1 on Sheet C10, and Detail 1 on Plan Sheet C10.
   8. Bid Alternate D will be selected if Bid Alternate C is not selected for construction. Bid Alternate D includes adding engineered fill in access road locations to solar drying bed No. 57 in lieu of 7.5” of AC pavement. Bid Alternate D replaces 7.5” of AC pavement with engineered fill shown on Plan Sheet C5 as “AC Access Road Type ‘B’ Paving Section”, Plan Sheet C7 areas referring to Detail 1 on Sheet C10, and Detail 1 on Plan Sheet C10.
9. Bid Alternate order of preference from most preferred to least preferred are C, B, A then D (if Alternate C is not selected).

1.2 CONTRACT

A. The Work shall be constructed under one prime contract.

1.3 WORK BY OWNER

A. OWNER will perform the following work:
   1. Operation of all existing system gates, valves and equipment, unless specified otherwise.

1.4 SEQUENCE AND PROGRESS OF WORK

A. Submit a Construction Schedule covering the entire Work in accordance with Section 01231, Progress Schedule.

B. Incorporate the requirements of Section 01111, Schedule of Completion, and Section 01143, Coordination with OWNER'S Operations, into the Construction Schedule. CONTRACTOR'S construction schedule may use a different sequence from that shown or specified, if techniques and methods known will result in cost and time savings to the OWNER, still achieve the required objective and maintain the same or greater level of treatment. The ENGINEER'S determination on the acceptability of any alternative sequence from that shown or specified shall be final.

C. CONTRACTOR: The project electric motor requirements, specified in Section 11000, Electric Motors, do not allow standard “off the shelf” motors. Make provisions in sequence and progress of Work to account for longer manufacturing and delivery lead times for the motors and equipment requiring electric motors under this project.

1.8 CONTRACTOR'S USE OF PREMISES

A. Coordinate use of the premises, for his storage and the operations of his workmen, with OWNER, ENGINEER and utility service companies.

B. The full use of the premises for storage, the operations of workmen and for all other construction activities will not be available to CONTRACTOR. Must operate entirely within the space allowed to him.

C. Sole responsibility for obtaining and paying all costs in connection with any additional work area, storage sites, access to the site or temporary right-of-way
which may be required for proper completion of the Work, belongs to CONTRACTOR.

D. It shall be understood that responsibility for protection and safe-keeping of equipment and materials on or near the site will be entirely that of CONTRACTOR and that no claim shall be made against the OWNER or his authorized representatives by reason of any act. It shall be further understood that should any occasion arise necessitating access to the sites occupied by these stored materials or equipment, the ENGINEER shall direct CONTRACTOR owning or responsible for the stored materials and equipment to immediately move the same. No materials or equipment may be placed upon the property of the OWNER, other than in the designated areas as shown on the Drawings, or as described in the specifications, unless the ENGINEER has agreed to the location contemplated by CONTRACTOR to be used for storage. All stored materials shall be labeled according to the appropriate contractor or subcontractor with the manufacturer's label as well. Appropriate material safety data sheets (e.g., MSDS) shall be provided.

E. Required to share use of the premises with other contractors whose services the OWNER has obtained or will obtain for construction of other facilities on the site.

1.9 EASEMENTS AND RIGHTS-OF-WAY

A. Easements and rights-of-way determined by the OWNER to be required to perform the Work will be provided by OWNER. Confine construction operations within the limits indicated on the Drawings. Use due care in placing construction tools, equipment, excavated materials, and pipeline materials and supplies in order to avoid damage to property and interference with traffic. Do not enter any private property outside the designated construction easement boundaries without written permission from the ENGINEER and the owner of the property. Any private property or rights-of-way owned by other than the OWNER, which CONTRACTOR wishes to utilize during the performance of the Work, shall be provided by CONTRACTOR.

1.10 NOTICES TO OWNERS AND AUTHORITIES OF PROPERTIES ADJACENT TO THE WORK

A. Notify owners of adjacent properties and utilities when prosecution of the Work may affect them.

B. When it is necessary to temporarily obstruct access to property, or when any utility service connection must be interrupted, give notices sufficiently in advance to enable the affected persons to provide for their needs. Conform notices to any applicable local ordinance and, whether delivered orally or in writing, include appropriate information concerning the interruption and instructions on how to limit inconvenience caused thereby.
C. Utilities and other concerned agencies shall be notified at least 72 hours prior to cutting or closing streets or other traffic areas or excavating near underground utilities or pole lines.

1.11 SALVAGE OF EQUIPMENT AND MATERIALS

A. Existing equipment and materials removed, and not shown or specified to be reused as a part of the Work, shall become CONTRACTOR’S property, except the following items which shall remain OWNER’S property:
   1. The area where equipment and components are stored and to be salvaged by OWNER is indicated on Plan Sheet C2.

B. Existing equipment and materials removed by CONTRACTOR shall not be reused in the Work, except where so specified or indicated.

C. Carefully remove, in a manner to prevent damage, all equipment and materials specified or indicated to be salvaged and reused or to remain the property of OWNER. Store and protect salvaged items specified or indicated to be reused in the Work. Replace in kind or with new items any items damaged in removal, storage, or handling through carelessness or improper procedures.

D. Furnish and install new items, with ENGINEER’S approval, instead of those specified by OWNER or indicated to be salvaged and reused, in which case such removed items will become CONTRACTOR’S property.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++
PART 1 - GENERAL

1.1 DESCRIPTION

A. Commence the Work promptly upon the date established in the Notice to Proceed and shall pursue it to completion in accordance with the Agreement as described in this Section.

B. The Schedule of Completion describes selected project components only and is not intended to describe all project Work or constraints, interrelationships, or sequentially required Work.

C. Completion of certain activities are directly related to treatment capacities at the COP 91st Ave. WWTP. A Shutdown Schedule, consisting of facility shutdowns, is included in Section 01143, Coordination with OWNER’S Operations.

D. Contract times, as well as liquidated damages for failure to Substantially Complete the Schedule of Completion specified in this Section, are defined in the Agreement.

1.2 SCHEDULE OF COMPLETION

A. Submit Shop Drawings in accordance with Section 01332, Shop Drawing Procedures, and the individual specification Sections. Submit early Shop Drawings as noted and as required to meet the Schedule of Completion.

B. The Schedule of Completion for the 91st Avenue WWTP Sludge Solar Drying Beds Project No. WS90100098 Project shall be as follows:

<table>
<thead>
<tr>
<th>Areas</th>
<th>Work/Work Sequence</th>
<th>Completion Calendar Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>All areas of project</td>
<td>All</td>
<td>300</td>
</tr>
</tbody>
</table>
PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++
SECTION 01140

WORK RESTRICTIONS

PART 1 - GENERAL

1.1 USE OF PREMISES

A. Limit use of premises to Work in areas indicated. Do not disturb portions of site beyond areas in which Work is indicated.

1. Limits: Confine construction operations to designated areas located in area of the existing solar drying beds No. 31, 57 and 58, and area around the Decant Pump Station No.2, as indicated in the contract drawings. Confine storage of materials and support facilities to designated areas located in the portion of the existing solar drying bed No. 58 that is not being used to construct new solar drying bed No. 57 (area east from the new solar drying bed No. 57).

2. Driveways and Entrances: At all times, keep driveways and entrances serving premises clear and available to OWNER, OWNER’S employees, and emergency vehicles. Coordinate with the requirements of Section 01550, Access Roads and Parking Areas. Do not use these areas for parking or storage of materials.

   a. Schedule deliveries to minimize use of driveways and entrances.
   b. Schedule deliveries to minimize space and time requirements for on-site storage of materials and equipment.

B. Promptly repair damage to premises caused by construction operations. Upon completion of the Work, restore premises to original condition.

(The remainder of this page was left blank intentionally.)

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

+ + END OF SECTION + +
COORDINATION WITH OWNER’S OPERATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. The intent of this Section is to provide CONTRACTOR a sequence to perform the Work in such a manner that continuous, uninterrupted Plant Treatment Processes and all essential Plant services and facilities are maintained operational throughout the construction period.

B. The sequences of Work and Schedule of Completion are specified under Section 01110, Summary of Work, and Section 01111, Schedule of Completion. The sequences have been assembled to maintain plant operations during construction.

C. CONTRACTOR’S means and methods shall be implemented such that the existing plant or facility, shall remain in continuous satisfactory operation during the entire construction period. Work shall be so scheduled and conducted by CONTRACTOR such that it shall not impede any treatment process, compromise plant security, create potential hazards to operating equipment and plant personnel, reduce the quality of the plant effluent or cause odor or other nuisances. In performing the Work shown and specified, plan and schedule the Work to meet both the constraints outlined in this Section and plant operating requirements.

D. Work not specifically covered in Section 01110, Summary of Work; and Section 01111, Schedule of Completion or in the following paragraphs may, in general, be done at anytime during normal work hours during the Contract period, subject to the operating requirements outlined in this Section. All references to days in this Section are consecutive calendar days.

E. The option of providing additional temporary facilities that can eliminate a constraint provided it is done without additional cost to the OWNER, presents no safety hazards, and provided that all requirements of these Specifications are fulfilled.

F. Responsible for coordinating all shutdowns and operation interruptions with the OWNER and ENGINEER. Whenever possible, combine discrete shutdown procedures identified in this Section or by CONTRACTOR into a single shutdown when the duration of the shutdowns or the Work requirements allow such combining to occur on a unit process or work area. The intent of combining procedures is to minimize the impacts upon plant operations and processes by limiting the number of shutdowns required.

G. Not shut-off or disconnect any operating system of the plant, unless approved by the ENGINEER, in writing. All plant equipment operations and shutdowns shall be executed by the
OWNER, unless otherwise noted. Seal OWNER operated gates and valves to prevent unnecessary leakage. After CONTRACTOR’S Work has been completed, remove the seal to the satisfaction of the ENGINEER.

H. This Section of the Specifications contains several references to equipment, piping, material and appurtenances to be removed or reinstalled. Refer to the Drawings, Section 02220, Demolitions, and other applicable Sections, for definition of the equipment, piping, material and appurtenances to be removed, turned over to the OWNER and stored on site, or to become the property of CONTRACTOR and removed from the site.

1.2 GENERAL CONSTRAINTS

A. Article 1.3, below, and Section 01111, Schedule of Completion, specify the location of interplant transport interruptions and solar drying beds that will be affected.

B. The following constraints shall be applied to all equipment and appurtenant utility systems on the plant site.
   1. Load limits on Access Roads: Existing and new underground facilities, such as electrical duct banks, pipelines, etc., in, under and crossing plant roads, have been designed for a maximum wheel load of an H20 vehicle. Not exceed this weight limit and shall provide means of protecting the underground facilities.
   2. Access to Plant Site: An unobstructed traffic route through all plant gates shall be maintained at all times.
   3. Safety Barriers: Place safety barriers around unsafe areas located around operational areas accessible to plant Personnel.
   4. Personnel Access: Treatment plant Personnel shall have access to all areas which remain in operation throughout the construction period.
   5. Potable Water System: The existing potable water system shall be kept in operation at all times, unless otherwise specified in Article 1.3, below.
   6. Plumbing Facilities: Sanitary facilities in the existing structures shall be operational at all times for plant Operating Personnel, unless otherwise specified in Article 1.5, below. All other building plumbing systems, such as roof and floor drains, pumping, etc., shall be maintained for all structures.
   7. Storm drainage: Storm drainage on the site shall be operational at all times, unless otherwise specified in Article 1.3, below.
   8. Building Heating and Ventilating: In CONTRACTOR’S Work areas and areas affected by CONTRACTOR’S operations, building heating and ventilating shall be both provided and maintained in structures, including pipe galleries. The temperatures to be maintained in any area occupied by plant Personnel, such as offices, lunchrooms, locker rooms, toilet rooms, facilities containing computer control equipment, etc., shall be at least 65°F and not greater than 80°F. The temperatures to be maintained in all other interior plant areas, whether new, existing or temporary, shall be maintained at a minimum of 55°F and not greater than 90°F.
9. Power, Light and Communication Systems: Electric power, lighting service and communication systems shall be maintained in uninterrupted operation in all areas, unless otherwise specified in Article 1.3, below.

10. Sump Pumps and Sumps: All existing sumps shall be maintained in an operable condition with either existing pumps or temporary pumps provided by CONTRACTOR. Interim piping, power and controls shall be provided by CONTRACTOR, as required by the construction sequence and as directed by the ENGINEER.

11. Seal and Service Water Piping: A supply of service and seal water and the necessary connections to existing equipment shall be maintained during construction, unless otherwise specified in Article 1.3, below. Interim piping shall be provided by CONTRACTOR, as required.

12. The OWNER will assist CONTRACTOR in dewatering process tanks, basins and other plant process Work areas. It is CONTRACTOR’S responsibility to maintain a clean and dry Work area by pumping and properly disposing of all washdown and cleaning water and stormwater that accumulates in the Work areas.

13. Draining Process Pipes and Conduits:
   a. Unless otherwise specified, the contents of pipes and conduits undergoing modifications shall be transferred to plant drain system using hoses, piping, pumps, or other applicable means.
   b. If a drain is not available on the pipe to be drained, then a wet tap shall be made by CONTRACTOR using a tapping saddle and valve approved by the ENGINEER. No uncontrolled spillage of a pipe’s contents shall be allowed.
   c. Any spillage shall be brought to the ENGINEER’S attention immediately in writing. Wash down any spillage to floor drains, sumps and sump pump discharge piping and then flush out the system to prevent clogging and septic odors. If spillage is not suitable for drainage system, e.g. chemical spills, etc, as determined by the ENGINEER, remove spillage by other method such as Vactor truck, as approved by the ENGINEER.

14. Temporary Partitions and Enclosures: Provide temporary partitions and enclosures necessary to maintain dust-free, heated and ventilated spaces in all areas which are adjacent to his Work and which must be kept operational.

15. Dead End Valves or Pipe: Provide blind flanges on all valves or pipes which dead-end a line on a temporary or permanent basis. Blind flanges shall be braced and blocked, as required or as directed by the ENGINEER in the field.

16. Schedule all start-ups for Monday through Thursday. No start-ups will be allowed on Friday, Saturday, and Sunday.

### 1.3 SHUTDOWNS

#### A. General:

1. A shutdown shall be defined as a portion of the normal operation of a plant unit or conduit that has to be suspended or taken out of service in order to perform the specified Work. For each shutdown, compile an inventory of labor and materials required to perform tasks, provide an estimate of the time required (including time for the OWNER to take down and
start-up the plant unit or conduit), and a written description of steps required to complete all tasks. The inventory, the estimate, and written procedures shall be submitted to the ENGINEER for review 20 calendar days prior to the proposed start date of the shutdown. Request, in writing from the ENGINEER, approval for each shutdown a minimum of 7 calendar days prior to the proposed shutdown date. No shutdown shall be initiated until the inventory of materials and labor is verified by the ENGINEER on site at least 1 week prior to the proposed start date.

2. The Work required herein and any other Work required by the ENGINEER which may interrupt the normal plant operations shall be accomplished at such times that will be convenient to the OWNER.

3. Have on hand and located in close proximity to the Work area, all tools, equipment, spare parts and materials, both temporary and permanent, necessary to complete each Work category without interruption. Adequate numbers of personnel shall be scheduled for each shutdown, so that the Work shall be accomplished within the specified time frame. Prefabrication of all piping and other assemblies shall be completed, to the greatest degree possible, prior to any shutdowns. The ENGINEER shall be satisfied that CONTRACTOR has complied with these requirements, to the fullest extent possible, before shutdowns will be authorized.

4. If CONTRACTOR’S procedures cause an unscheduled shutdown of the facilities, perform Work as necessary to immediately re-establish satisfactory operation. Notify the ENGINEER, in writing, immediately of any unscheduled shutdown. Permit OWNER’S personnel to work with CONTRACTOR’S personnel, as required, to maintain the plant in continuous satisfactory operation. Unscheduled shutdowns or interruptions of continued safe and satisfactory operation of the facilities that result in fines levied by the U.S. Environmental Protection Agency, Arizona Department of Environmental Quality, Maricopa County Health Department Bureau of Air Pollution Control, or the Maricopa County Department of Environmental Management shall be the responsibility of CONTRACTOR if it is demonstrated that CONTRACTOR was negligent in the Work or did not exercise proper precautions in the conduct of the Work.

5. The scheduled shutdowns during the period of CONTRACTOR’S Work will be as shown in Table 01143-A. All Work requiring the plant to be out-of-service shall be performed during the scheduled shutdowns shown. It should be noted plant staff shall continue to perform administrative, operation and maintenance functions during shutdowns.

6. Electrical Ductbank Installation: Shutdown and relocation of conflicting utilities alignments with electrical ductbank will only be allowed for certain types of process pipelines. Any shutdown and relocations shall follow a strict time schedule in order to minimize impact to plant operations.

B. Shutdowns of Electrical Systems: Lock out and tag circuit breakers and switches operated by the OWNER and shall check cables and wires to be sure that they are de-energized to ground potential before Work begins. Upon completion of the Work, remove the locks and tags and notify the ENGINEER that the facilities are available for use.
<table>
<thead>
<tr>
<th>Area</th>
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<th>Constraints</th>
<th>Dates/Duration</th>
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<tr>
<td>Access road to solar drying beds near and around Decant Pump Station No.2</td>
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<td></td>
<td>5 days</td>
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</table>

1.4 OVERTIME

A. All overtime Work by CONTRACTOR necessary to conform to the requirements of this Section shall be performed by CONTRACTOR, at no additional cost to the OWNER and shall be performed in accordance with the General Conditions. Make no claims for extra compensation as a result thereof.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++
SECTION 01271

MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. The items listed below, beginning with Article 1.4, refer to and are the same pay items listed in the Bid Form. They constitute all of the pay items for the completion of the Work. No direct or separate payment shall be made for providing miscellaneous temporary or accessory works, plant services, CONTRACTOR’S or ENGINEER’S field offices, layout surveys, job signs, sanitary requirements, testing, safety devices, approval and Record Drawings, water supplies, power, traffic maintenance, removal of waste, watchmen, bonds, insurance, or all other requirements of the General Conditions, Supplementary Conditions, and the Contract Requirements. Compensation for all such services, items and materials shall be included in the prices stipulated for the lump sum and unit price pay items listed herein.

B. Each lump sum and unit bid price shall be deemed to include an amount considered by CONTRACTOR to be adequate to cover CONTRACTOR’S overhead and profit for each separately identified item.

1.2 ENGINEER’S ESTIMATE OF QUANTITIES

A. ENGINEER’S estimated quantities for unit price pay items, as listed in the Bid Form, are approximate only and are included solely for the purpose of comparison of Bids. OWNER does not expressly or by implication agree that the nature of the materials encountered below the surface of the ground or the actual quantities of material encountered or required shall correspond therewith and reserves the right to increase or decrease any quantity or to eliminate any quantity as OWNER may deem necessary. Not entitled to any adjustment in a unit bid price as a result of any change in an estimated quantity and agrees to accept the aforesaid unit bid prices as complete and total compensation for any additions or deductions caused by changes or alterations in the Work directed by OWNER.

1.3 RELATED PROVISIONS

A. Payments to CONTRACTOR: Refer to General Conditions and Agreement.

B. Changes in Contract Price: Refer to General Conditions.
C. Schedule of Values: Refer to Section 01291, Schedule of Values.

D. Pay Application: Refer to Section 01331, Reference Forms.

1.4 GENERAL

A. Item 1 – Mobilization / Demobilization:
   1. Measurement and Payment: The lump sum payment for Item 1 will be full compensation for mobilization / demobilization.

B. Item 2 – Drying Bed 57 Clearing and Grubbing:
   1. Measurement and Payment: The lump sum payment for Item 2 will be full compensation for clearing and grubbing in Drying Bed 57.

C. Item 3 – Drying Bed 57 Concrete Box Demolition:
   1. Measurement and Payment: The unit price of each for Item 3 will be full compensation for the demolition of concrete decant boxes in Drying Bed 57.

D. Item 4 – Excess Material and Old Equipment Hauling and Disposal:
   1. Measurement and Payment: The lump sum payment for Item 4 will be full compensation for hauling and disposing of excess material and old equipment designated in Drying Beds 57 and 58.

E. Item 5 – Drying Bed 57 Excavation (Including Existing Levee):
   1. Measurement and Payment: The unit price per cubic yard for Item 5 will be full compensation for excavation necessary for the construction of Drying Bed 57, including the levee between Drying Beds 57 and 58.

F. Item 6 – Drying Bed 57 Fill – Screened Native (Including New Levee):
   1. Measurement and Payment: The unit price per cubic yard for Item 6 will be full compensation for the installation of screened native fill necessary for the construction of Drying Bed 57, including the levee between Drying Beds 57 and 58.

G. Item 7 – Drying Bed 57 Engineered Fill (Including New Levee):
   1. Measurement and Payment: The unit price per cubic yard for Item 7 will be full compensation for the installation of engineered fill necessary for the construction of Drying Bed 57, including the levee between Drying Beds 57 and 58.

H. Item 8 – Drying Bed 57 Paving (Bed Only):
   1. Measurement and Payment: The unit price per ton for Item 8 will be full compensation for the installation of AC Pavement within Drying Bed 57, not including access roadways.
I. Item 9 – Access Road Subbase Preparation (Including Top of Levee):
   1. Measurement and Payment: The unit price per square foot for Item 9 will be full compensation for the installation of subbase for access road construction.

J. Item 10 – Drying Bed 57 Decant Boxes Complete, Including Concrete, Handrailing and Grating, and Weir Gate:
   1. Measurement and Payment: The unit price of each for Item 10 will be full compensation for the installation of decant boxes in Drying Bed 57 complete with concrete, handrailing and grating, and weir gate.

K. Item 11 – 12” Decant Pipe, Including Materials and Installation:
   1. Measurement and Payment: The unit price per linear foot for Item 11 will be full compensation for the installation of 12” decant pipe from Drying Bed 57 to Decant Pump Station No. 2.

L. Item 12 – 15” Decant Pipe, Including Materials and Installation:
   1. Measurement and Payment: The unit price per linear foot for Item 12 will be full compensation for the installation of 15” decant pipe from Drying Bed 57 to Decant Pump Station No. 2.

M. Item 13 – Manholes, Including Materials and Installation:
   1. Measurement and Payment: The unit price of each for Item 13 will be full compensation for the installation of manholes located on the decant pipeline from Drying 57 to Decant Pump Station No. 2.

N. Item 14 – Allowance for Extra Work:
   1. Measurement and Payment: The partial lump sum payment for Item 14 is for unforeseen conditions, but only to be utilized with prior written approval from OWNER and ENGINEER associated with Work Change Directives and/or Request For Proposals.

O. Item A1 – Drying Bed 31 Clearing and Grubbing:
   1. Measurement and Payment: The lump sum payment for Item A1 will be full compensation for clearing and grubbing in Drying Bed 31. This item is part of Bid Alternate A.

P. Item A2 – Drying Bed 31 Concrete Box Demolition:
   1. Measurement and Payment: The unit price of each for Item A2 will be full compensation for the demolition of concrete decant box in Drying Bed 31. This item is part of Bid Alternate A.

Q. Item A3 – Drying Bed 31 Excess Material and Old Equipment Hauling and Disposal:
1. Measurement and Payment: The lump sum payment for Item A3 will be full compensation for hauling and disposing of excess material and old equipment in Drying Bed 31. This item is part of Bid Alternate A.

R. Item A4 – Drying Bed 31 Excavation:
1. Measurement and Payment: The unit price per cubic yard for Item A4 will be full compensation for excavation necessary for the construction of Drying Bed 31. This item is part of Bid Alternate A.

S. Item A5 – Drying Bed 31 Fill – Screened Native:
1. Measurement and Payment: The unit price per cubic yard for Item A5 will be full compensation for the installation of screened native fill necessary for the construction of Drying Bed 31. This item is part of Bid Alternate A.

T. Item A6 – Drying Bed 31 Engineered Fill:
1. Measurement and Payment: The unit price per cubic yard for Item A6 will be full compensation for the installation of engineered fill necessary for the construction of Drying Bed 31. This item is part of Bid Alternate A.

U. Item A7 – Drying Bed 31 Paving:
1. Measurement and Payment: The unit price per ton for Item A7 will be full compensation for the installation of AC Pavement within Drying Bed 31, not including access roadways. This item is part of Bid Alternate A.

V. Item A8 – Drying Bed 31 Decant Box Complete, Including Concrete, Handrailing and Grating, and Weir Gate:
1. Measurement and Payment: The unit price of each for Item A8 will be full compensation for the installation of decant box in Drying Bed 31 complete with concrete, handrailing and grating, and weir gate. This item is part of Bid Alternate A.

W. Item A9 – 12” Decant Pipe, Including Materials and Installation:
1. Measurement and Payment: The unit price per linear foot for Item A9 will be full compensation for the installation of 12” decant pipe from Drying Bed 31 to Decant Pump Station No. 2. This item is part of Bid Alternate A.

X. Item A10 – Manholes, Including Materials and Installation:
1. Measurement and Payment: The unit price of each for Item A10 will be full compensation for the installation of manholes located on the decant pipeline from Drying 31 to Decant Pump Station No. 2. This item is part of Bid Alternate A.

Y. Item B1 – Demolition of Existing Pumps, Valves and Piping:
1. Measurement and Payment: The lump sum payment for Item B1 will be full compensation for the demolition and removal of equipment and materials from Decant Pump Station No. 2. This item is part of Bid Alternate B.

Z. Item B2 – 15 HP Pump, Installed:
   1. Measurement and Payment: The unit price of each for Item B2 will be full compensation for providing and installing a 15 HP pump at Decant Pump Station No. 2. This item is part of Bid Alternate B.

AA. Item B3 – 3 HP Pump, Installed:
   1. Measurement and Payment: The unit price of each for Item B3 will be full compensation for providing and installing 3 HP pumps at Decant Pump Station No. 2. This item is part of Bid Alternate B.

AB. Item B4 – Sump Pumps, Installed:
   1. Measurement and Payment: The unit price of each for Item B4 will be full compensation for providing and installing sump pumps at Decant Pump Station No. 2. This item is part of Bid Alternate B.

AC. Item B5 – 12-inch Diameter DIP Above Grade:
   1. Measurement and Payment: The unit price per linear foot for Item B5 will be full compensation for the installation of 12” ductile iron pipe above grade at Decant Pump Station No. 2. This item is part of Bid Alternate B.

AD. Item B6 – Two (2) New 12-inch Connections to 72” SRO:
   1. Measurement and Payment: The lump sum payment for Item B6 will be full compensation for the connections of the 12” discharge pipes from Decant Pump Station No. 2 to the 72” SRO. This item is part of Bid Alternate B.

AE. Item B7 – New Exhaust Fan:
   1. Measurement and Payment: The unit price of each for Item B7 will be full compensation for providing and installing a new exhaust fan at Decant Pump Station No. 2. This item is part of Bid Alternate B.

AF. Item B8 – 3-inch Diameter DIP in Drywell:
   1. Measurement and Payment: The unit price per linear foot for Item B8 will be full compensation for the installation of 3” ductile iron pipe in the Decant Pump Station No. 2 drywell. This item is part of Bid Alternate B.

AG. Item B9 – 4-inch Diameter DIP in Drywell:
   1. Measurement and Payment: The unit price per linear foot for Item B9 will be full compensation for the installation of 4” ductile iron pipe in the Decant Pump Station No. 2 drywell. This item is part of Bid Alternate B.
AH. Item B10 – 6-inch Diameter DIP in Drywell:
   1. Measurement and Payment: The unit price per linear foot for Item B10 will be
      full compensation for the installation of 6” ductile iron pipe in the Decant
      Pump Station No. 2 drywell. This item is part of Bid Alternate B.

AI. Item B11 – Reclaimed Water Piping for Flush Water:
   1. Measurement and Payment: The lump sum payment for Item B11 will be full
      compensation for the reclaimed water flush piping installation. This item is part
      of Bid Alternate B.

AJ. Item B12 – 3-inch Diameter Plug Valves:
   1. Measurement and Payment: The unit price of each for Item B12 will be full
      compensation for providing and installing 3” plug valves at Decant Pump
      Station No. 2. This item is part of Bid Alternate B.

AK. Item B13 – 4-inch Diameter Plug Valves:
   1. Measurement and Payment: The unit price of each for Item B13 will be full
      compensation for providing and installing 4” plug valves at Decant Pump
      Station No. 2. This item is part of Bid Alternate B.

AL. Item B14 – 6-inch Diameter Plug Valves:
   1. Measurement and Payment: The unit price of each for Item B14 will be full
      compensation for providing and installing 6” plug valves at Decant Pump
      Station No. 2. This item is part of Bid Alternate B.

AM. Item B15 – 12-inch Diameter Plug Valves:
   1. Measurement and Payment: The unit price of each for Item B15 will be full
      compensation for providing and installing 12” plug valves at Decant Pump
      Station No. 2. This item is part of Bid Alternate B.

AN. Item B16 – 3-inch Check Valves:
   1. Measurement and Payment: The unit price of each for Item B16 will be full
      compensation for providing and installing 3” check valves at Decant Pump
      Station No. 2. This item is part of Bid Alternate B.

AO. Item B17 – 6-inch Check Valves:
   1. Measurement and Payment: The unit price of each for Item B17 will be full
      compensation for providing and installing 6” check valves at Decant Pump
      Station No. 2. This item is part of Bid Alternate B.

AP. Item B18 – Paint Electrical Building:
   1. Measurement and Payment: The lump sum payment for Item B18 will be full
      compensation for painting the Decant Pump Station No. 2 electrical building.
      This item is part of Bid Alternate B.
AQ. Item B19 – 12” Flowmeter, Installed:
   1. Measurement and Payment: The unit price of each for Item B19 will be full compensation for providing and installing a new 12” flowmeter at Decant Pump Station No. 2. This item is part of Bid Alternate B.

AR. Item B20 – Electrical and Instrumentation Components, Installed:
   1. Measurement and Payment: The lump sum payment for Item B20 will be full compensation for providing, installing and testing electrical and instrumentation equipment at Decant Pump Station No. 2. This item is part of Bid Alternate B.

AS. Item C1 – Access Road Paving (Including Top of Levee):
   1. Measurement and Payment: The unit price per ton for Item C1 will be full compensation for the installation of AC Pavement for the access roads in the vicinity of Drying Bed 57. This item is part of Bid Alternate C.

AT. Item D1 – Access Roads Engineered Fill in Lieu of 7.5” AC Pavement:
   1. Measurement and Payment: The unit price per cubic yard for Item D1 will be full compensation for the installation of engineered fill necessary for the substitution of 7.5” of AC pavement in the access roadways in the vicinity of Drying Bed 57 if Bid Alternate C is not selected. This item is part of Bid Alternate D.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++
PART 1 - GENERAL

1.1 DESCRIPTION

A. The Preliminary Schedule of Values is an itemized list that establishes the value or cost of each major part of the Work and the division of Work between CONTRACTOR and subcontractors.

B. The Preliminary Schedule of Values shall include all items of Work in the Contract Documents.

C. The Schedule of Values is a detailed itemized list that establishes the value or cost of each detailed part of the Work. It and the Progress Schedule updates specified in Section 01321 Progress Schedule, shall be used as the basis for preparing progress payments. The Schedule of Values may be used as a basis for negotiations, concerning additional work or credits, which may arise during the construction. Quantities and unit prices shall be included in the schedule, when approved by or required by the ENGINEER.

D. The Preliminary Schedule of Values and Schedule of Values itemized list of Work, for each major part of the Work and division of Work shall be grouped under the following index areas (note that the list of Bid Alternate items are in OWNER order of preference):

1. Mobilization / Demobilization
2. Drying Bed 57 Clearing and Grubbing
3. Drying Bed 57 Concrete Box Demolition
4. Excess Material and Old Equipment Hauling and Disposal
5. Drying Bed 57 Excavation (Including Existing Levee)
6. Drying Bed 57 Fill – Screened Native (Including New Levee)
7. Drying Bed 57 Engineered Fill (Including New Levee)
8. Drying Bed 57 Paving (Bed Only)
9. Access Road Subbase Preparation (Including Top of Levee)
10. Drying Bed 57 Decant Boxes Complete, Including Concrete, Handrailing and Grating, and Weir Gate
11. 12” Decant Pipe, Including Materials and Installation
12. 15” Decant Pipe, Including Materials and Installation
13. Manholes, Including Materials and Installation
14. Allowance for Extra Work
15. Access Road Paving (Including Top of Levee) (Alternate C)
16. Demolition of Existing Pumps, Valves and Piping (Alternate B)
17. 15 HP Pump, Installed (Alternate B)
18. 3 HP Pump, Installed (Alternate B)
19. Sump Pumps, Installed (Alternate B)
20. 12-inch Diameter DIP Above Grade (Alternate B)
21. Two (2) New 12-inch Connections to 72” SRO (Alternate B)
22. New Exhaust Fan (Alternate B)
23. 3-inch Diameter DIP in Drywell (Alternate B)
24. 4-inch Diameter DIP in Drywell (Alternate B)
25. 6-inch Diameter DIP in Drywell (Alternate B)
26. Reclaimed Water Piping for Flush Water (Alternate B)
27. 3-inch Diameter Plug Valves (Alternate B)
28. 4-inch Diameter Plug Valves (Alternate B)
29. 6-inch Diameter Plug Valves (Alternate B)
30. 12-inch Diameter Plug Valves (Alternate B)
31. 3-inch Check Valves (Alternate B)
32. 6-inch Check Valves (Alternate B)
33. Paint Electrical Building (Alternate B)
34. 12” Flowmeter, Installed (Alternate B)
35. Electrical and Instrumentation Components, Installed (Alternate B)
36. Drying Bed 31 Clearing and Grubbing (Alternate A)
37. Drying Bed 31 Concrete Box Demolition (Alternate A)
38. Drying Bed 31 Excess Material and Old Equipment Hauling and Disposal (Alternate A)
39. Drying Bed 31 Excavation (Alternate A)
40. Drying Bed 31 Fill – Screened Native (Alternate A)
41. Drying Bed 31 Engineered Fill (Alternate A)
42. Drying Bed 31 Paving (Alternate A)
43. Drying Bed 31 Decant Box Complete, Including Concrete, Handrailing and Grating, and Weir Gate (Alternate A)
44. 12” Decant Pipe, Including Materials and Installation (Alternate A)
45. Manholes, Including Materials and Installation (Alternate A)
46. Access Roads Engineered Fill in Lieu of 7.5” AC Pavement (Alternate D)

E. The Schedule of Values shall include an itemized list of Work for all Maintenance of Plant Operations (MOPO) Work as specified in Section 01143, Coordination with OWNER'S Operations. Itemized MOPO Work shall be included within applicable major Work area.

1.2 PREPARATION

A. The Preliminary Schedule of Values:
   1. Preliminary Schedule of Values shall show all Work under the index areas listed in Paragraph 1.1.D., above.
   2. Preliminary Schedule of Values shall show the division of Work between CONTRACTOR and subcontractors by two methods, one for each Section of the Specifications and also one for each structure.
3. Preliminary Schedule of Values shall show breakdown of labor, materials equipment and other costs used in preparation of the Bid for CONTRACTOR and subcontractors.
4. Costs shall be in sufficient detail to indicate separate amounts for each Section of the Specifications and for each structure.
5. May include an item for bond, insurance, and temporary facilities.
6. Preliminary Schedule of Values shall be prepared on 8-1/2-inch by 11-inch white paper.
7. Use Table of Contents of the Specifications as basis for Preliminary Schedule of Values format and identify each item with number and title in the Table of Contents. Also, use each structure as basis for Schedule of Value format. List sub-items of major products or systems, as appropriate or when requested by ENGINEER.
8. When requested by ENGINEER, support values with data that will substantiate their correctness.
9. The sum of the individual values shown on the Preliminary Schedule of Values shall equal the total Contract Price.
10. Each item shall include a directly proportional amount of CONTRACTOR’S overhead and profit.

B. The Schedule of Values:
1. Schedule of Values shall show breakdown of quantities, labor, materials, equipment, and other costs used in preparation of the Bid for each item in the Schedule of Values.
2. Schedule of Values shall show all Work under the index areas listed in Paragraph 1.1.D., above.
3. Costs shall be prepared by two methods, one for each Section of the Specifications and one for each structure. They shall be in sufficient detail to indicate separate amounts for each Section of the Specifications and subsections therein and also separate amounts for each structure. Amounts shall be included for each type of Work specified, in a manner approved by the ENGINEER.
4. Include separate pay items for Mobilization and Demobilization, as specified in the Contract Documents.
5. Fifteen percent of the total cost of each item is allotted to the cost of Shop Drawing preparation, Operation and Maintenance Manuals, Testing and Training. This amount will be released upon approval, by the ENGINEER, three percent is apportioned to Testing and four percent each to the remaining items.
6. Schedule of Values shall be prepared on 8-1/2-inch by 11-inch white paper.
7. Use Table of Contents of the Specifications and the form included with Section 01330, Submittals, as basis for Schedule of Values format and identify each item with number and title in the Table of Contents. Also, use each structure as basis for schedule format. List sub-items of major products or systems, as appropriate or when requested by ENGINEER.
8. When requested by ENGINEER, support values with data that will substantiate their correctness.

9. The sum of the individual values shown on the Schedule of Values shall equal the total Contract Price.

10. Each item shall include a directly proportional amount of CONTRACTOR'S overhead and profit.

11. Schedule of Values shall show the purchase and delivery costs for materials and equipment that CONTRACTOR anticipates he shall request payment for prior to their installation.

12. Include a separate pay item for Maintenance of Plant Operations (MOPO) Work for each major Work area.

13. Include a separate pay item for: Construction Photographs; Temporary Facilities; Temporary Controls; Progress Schedule; General Conditions; and Field Engineering.

14. Include a separate pay item for all Allowances and Extra Unit quantities.

15. The Schedule of Values shall be prepared to a level of detail equal to or greater than required by the Supplementary Conditions.

1.3 SUBMITTALS

A. Submit two copies of the Preliminary Schedule of Values to ENGINEER for review within 10 days after the Notice to Proceed.

B. Submit two copies of the Schedule of Values to ENGINEER for review within 30 days after the Notice to Proceed.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++
SECTION 01301

PRE-CONSTRUCTION CONFERENCE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Date, Time and Location: Conference will be held after notice of award of the Contract. ENGINEER will fix the date, time and location of the meeting, within 30 days of notice of award.

B. ENGINEER shall prepare agenda, preside at meeting, and prepare and distribute a transcript of proceedings to all parties.

C. Provide data required, contribute appropriate items for discussion, and be prepared to discuss all items on agenda.

D. Unless previously submitted to ENGINEER, bring to the conference a preliminary schedule of each of the following:
   1. Progress Schedule.
   2. Shop Drawing and Sample submittals.
   3. Schedule of Values.

1.2 REQUIRED ATTENDANCE

A. Conference shall be attended by CONTRACTOR’S Project Manager, its superintendent and its major subcontractors and major equipment suppliers as CONTRACTOR deems appropriate.

B. OWNER’S representative.

C. ENGINEER.

D. Representatives of governmental agencies having any degree of control or responsibility, if available.

E. Utility company representatives.
1.3 PURPOSE

A. The purpose of the Pre-construction conference is to designate responsible personnel and establish working relationships. Matters requiring coordination will be discussed and procedures for handling such matters will be established. A complete agenda will be furnished to CONTRACTOR prior to the Pre-construction conference date. However, be prepared to discuss all of the following; but will not necessarily be limited to the following:
1. Designation of responsible personnel.
2. Subcontractors.
3. Coordination with other contractors and projects.
4. Progress schedule.
5. Processing of Shop Drawing Submittals.
6. Schedule of Shop Drawing submittals.
7. Processing of Field Orders, Requests for Information and Clarification and Change Orders.
8. Requirements for copies of Contract Documents.
10. Schedule of values.
11. Processing and Schedule of Payments.
12. Use of premises.
13. CONTRACTOR responsibility for safety and first aid procedures.
15. Housekeeping.
16. Field Offices.
17. Maintaining Record Drawings.
18. Letter of Notice to Proceed.
19. Permits.
20. Emergency Telephone Numbers.
22. Temporary Utilities.
23. I&C Inspection & Testing Services Coordination
24. Electrical Arc Flash Coordination
25. Any other project related items.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

91st Avenue WWTP Sludge Solar Drying Beds
01301-2
06/09/17
SECTION 01311

PROJECT COORDINATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. As more fully set forth in of the General Conditions, sole responsibility for coordination of all of the Work, belongs to CONTRACTOR. Supervise, direct and cooperate fully with all subcontractors, manufacturers, fabricators, suppliers, distributors, installers, testing agencies and all others whose services, materials or equipment are required to ensure completion of the Work within the Contract Time.

B. As more fully set forth in of the General Conditions, Cooperate with and coordinate the Work with the work of any other contractor, including the following, utility service companies or OWNER’S employees performing work at the site:
   1. Synagro for Inter-plant cake transport to the existing solar drying beds.
   2. Plant staff working in the existing solar drying beds

C. Not be responsible for damage done by contractors not under CONTRACTOR’S jurisdiction. Will not be liable for any such loss or damage, unless it is through the negligence of CONTRACTOR.

D. Coordinate the Work with the work of others to assure compliance with schedules.

E. Attend and participate in all project coordination or progress meetings and report on the progress of all Work and compliance with schedules.

F. It is the duty of the CONTRACTOR to determine that all necessary permits have been obtained. The CONTRACTOR, at his own expense, obtain, maintain and close all the required permits which have not been furnished.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++
SECTION 01312

PROGRESS MEETINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Date and Time:
   1. Regular Meetings: Every week on a day and time agreeable to OWNER, ENGINEER and CONTRACTOR.
   2. Other Meetings: As needed and/or required in other specific specification sections.

B. Place: CONTRACTOR'S field office at Project site, or other mutually agreed upon location.

C. The CONTRACTOR shall conduct weekly progress meetings, record and distribute minutes of the meeting to all attendees and others as requested. At a minimum, the agenda will include: Requests for Information (RFI) and submittal status, past week’s progress and a 3-week look-ahead schedule to include upcoming inspections, current issues, long lead items, critical issues and the next scheduled meeting date.

D. Provide data required and be prepared to discuss all items on agenda.

1.2 MINIMUM ATTENDANCE

A. CONTRACTOR:
   1. When needed for the discussion of a particular agenda item, require representatives of subcontractors or suppliers to attend a meeting.

B. ENGINEER.

C. OWNER'S representative, if required.

D. Others, as appropriate.

E. Representatives present for each party shall be authorized to act on their behalf.

1.3 AGENDA

A. Agenda will include, but will not necessarily be limited to, the following:
   1. Transcript of previous meeting.
2. Progress since last meeting.
   a. CONTRACTOR’S.
   b. Subcontractors’.

3. Completion status.

4. Planned progress for next period including a 3-week look-ahead schedule to include upcoming inspections.

5. Document and track to correction and closure any problems, conflicts, issues, and observations that are voiced by anyone of the project team.

6. Status of Shop Drawings, submittals, long lead items, RFI and RFAs.

7. Change Orders.

8. Pay Requests.


10. Schedules, updated Project Schedules, including off-site fabrication and delivery schedules; corrective measures, if required.

11. Coordination between parties.


13. Safety concerns.


15. Record Drawings.

16. Warranty Requests.

17. Punch List Status.

18. Other business.

19. Next meeting date.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

+ + END OF SECTION + +
SECTION 01321

PROGRESS SCHEDULE (CPM)

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section describes the Progress Schedule requirements to ensure that interim milestone dates will be met and completion of the Work will be accomplished within the time established. ENGINEER’S opinions concerning the various scheduling documents and reports are not controlling CONTRACTOR’S independent judgement concerning means, methods, and sequences of construction CONTRACTOR employs. Sole responsibility for meeting the Contract time(s) given in these Contract Documents, belongs to CONTRACTOR.

B. No later than 10 calendar days after the Notice to Proceed, submit a Preliminary Progress Schedule. The Preliminary Progress Schedule shall be referenced to time. The balance of Work leading to Substantial Completion of the Project shall be included, in a summary format.

C. No later than 20 calendar days after the Notice to Proceed, submit to the ENGINEER a 90-day Bar Chart Schedule prepared in accordance with Article 1.1 through 1.6, herein. The 90-day Bar Chart Schedule shall detail the first 90 calendar days of the Project.

D. No later than 40 calendar days after the Notice to Proceed, submit to the ENGINEER a full Progress Schedule prepared in accordance with Articles 1.1 through 1.7, herein. Upon review and acceptance, the CONTRACTOR’S submitted full progress schedule, described in this paragraph, will be deemed to be the “Baseline Schedule”. (The use of the term “Baseline Schedule” refers to the early dates; the late dates are for the purpose of calculating float, and do not represent the schedule). This Baseline Schedule shall be used by the CONTRACTOR for planning, scheduling and executing the Work and for monitoring and reporting progress to the ENGINEER. No changes to the Baseline Schedule may be made by the CONTRACTOR without the approval of the ENGINEER.

E. To ensure completion of the Work within the contract times established, all of CONTRACTOR’S activities shall be scheduled and monitored by use of a Critical Path Method (CPM) Progress Schedule. Provide a CPM Schedule for Work done under this Contract, in accordance with this Section, and the sequence and progress of Work requirements included under Section 01110, Summary of Work, Section 01111, Schedule of Completion and Section 01143, Coordination with OWNER’S Operations, the Supplementary Conditions and the Construction Sequence Diagram.
F. The Progress Schedule shall be prepared by CONTRACTOR using the Critical Path Method (CPM) utilizing the latest version of Primavera Project Planner software with Primavision (Primavera Project Planner and Primavision are U.S. registered trademarks of Primavera Systems, Inc., Bala Cynwyd, PA), or approved equal as determined by the OWNER and ENGINEER, conforming to the requirements hereinafter described.

1.2 SCHEDULING CONSULTANT

A. Engage, at his expense, a Scheduling Consultant or a qualified CONTRACTOR’S employee who has experience and is skilled in the time and cost application of CPM network techniques using Primavera on Wastewater construction projects to assist in the preparation of the Project Schedule. Prior to engaging a Scheduling Consultant or a qualified CONTRACTOR’S employee, Submit to the ENGINEER:

1. The name and address of the proposed Scheduling Consultant or qualified CONTRACTOR’S employee and the names of those persons who would be dedicated to this Project.
2. Sufficient information to show that the proposed Scheduling Consultant or qualified CONTRACTOR’S employee and the persons dedicated to this Project, have the qualifications to meet the Progress Schedule requirements.

B. The ENGINEER shall have the right to approve or disapprove the proposed Scheduling Consultant or qualified CONTRACTOR’S employee and will notify CONTRACTOR of his decision within 7 calendar days from receipt of information. In case of rejection, CONTRACTOR shall submit qualifications of another consultant within 7 calendar days for renewed considerations. Such approval or disapproval does not release CONTRACTOR from his obligations under this Contract.

1.3 LOGIC DIAGRAM

A. CONTRACTOR’S Scheduling Consultant or qualified CONTRACTOR’S employee shall prepare and submit a complete reproducible set of pure logic diagrams as generated by Primavera on 24-inch by 36-inch, or 11-inch by 17-inch drawings. The logic diagrams shall be grouped by Area and show the order and interdependence of activities and the sequence and quantities in which the Work is to be accomplished. Interrelationships to or from activities outside the area shown will be depicted by an activity symbol with activity number and description shown from the Primavera program. The basic concept of Precedence Diagramming Method (PDM) network scheduling shall be followed to show how the start of a given activity is dependent on the completion of preceding activities and how its completion may affect the start of following activities. The level of schedule detail shall define the day-to-day activities of the construction Work. No construction activity duration shall be longer than Ten (10) working days without prior approval.
B. The critical path shall be distinguished from other paths on the network. The logic diagrams shall be banded by major work systems, including one system for procurement and by specific area within each system. Logic diagrams shall include the following:
1. Activity number.
2. Activity description.
3. Activity duration (work days).
5. Slack or float of each activity.
7. Area code.
8. Responsibility code (e.g., CONTRACTOR, subcontractors, trades, operations, suppliers, ENGINEER, or other party responsible for accomplishment of an activity).
9. Shift number (if more than one shift per day is to be employed).

C. In addition to construction activities, network activities shall include the submittal and approval of samples of materials, shop and working drawings, and fabrication of special materials. It shall include all documents and proofs of compliance required by the Contract Documents for Final Inspection and Acceptance of the Work.

D. The Schedule Document shall include a System and Acceptance schedule within the project CPM schedule. This schedule will identify all equipment and systems that require testing, training and acceptance by the City of Phoenix. The durations and sequences of the systems testing and acceptance must be as specified in the various sections of the contract specification. Each system will contain, but will not be limited to, all of the following activities and constraints:
1. Interface between the construction activities and their respective system.
2. CONTRACTOR’S pre-testing work.
3. Submittal and Approval of the CONTRACTOR’S Pre-testing Data and checklist, as appropriate.
4. Sufficient notification time to the City of Phoenix prior to system testing.
5. Submittal and Approval of the Preliminary and Final As-Built Drawings.
6. Submittal and Approval of the Preliminary and Final O&M Manuals.
7. Submittal and Approval of Testing Procedures.
8. All other systems that are required to be tested and accepted prior to the specific system being tested.
9. System Testing by the City of Phoenix.
10. Other outside agencies, utilities, etc., that are required to test, witness and accept the system.
E. All activities of the ENGINEER/OWNER that affect progress and special dates required by the Contract shall be shown.

1.4 MATHEMATICAL TABULATIONS

A. The mathematical tabulation of the network diagram shall include tabulation of each activity shown on the detailed network diagram.

B. The information listed below shall be furnished as a minimum for each activity. All submittal and updates shall consist of Three (3) copies of the reports described below and two sets of compact discs (CD’s) containing Primavera schedule backups. The minimum required information includes:

1. Activity number.
2. Activity description.
3. Activity duration (work days).
4. Earliest start date (calendar date).
5. Earliest finish date (calendar date).
6. Latest start date (calendar date).
7. Latest finish date (calendar date).
8. Slack or float of each activity.
9. Quantities involved for each construction activity with manhour requirements and dollar values.
10. Critical path activities denoted.
11. Work days calendar which extends for not less than the length of the contract, plus six months.

C. The mathematical tabulation shall be in the form of computer-generated reports. The reports shall be bound in booklet form, indexed, and separated by tabbed dividers. Computer-generated reports, of the following sorts, provided by CONTRACTOR:

2. Critical Path Activities Report by Early Start.
3. Area Schedule Report for each System by Area/Early Start/Total Float.
5. 60-Day Look-Ahead Report by Area for Each System, then by activity number (with update line).
6. Man-hour Resource Reports:
   b. Monthly Projected Man-hour Flow Report (Tabular) with Manpower Resource Graphic on 24-inch by 36-inch, or 11-inch by 17-inch Sheet.
   c. Man-hour Summary by Area.
   d. Detailed Man-hour by Area/by Activity Report.
1.5 NARRATIVE REPORT

A. Prepare, and include with his original Progress Schedule submission, a narrative report describing the contract requirements and objectives and CONTRACTOR’S plan and schedule for achieving those requirements and objectives. The narrative shall describe the methods of operation, the resources to be employed, time frames for the construction of each of the major systems on the project, and time frames for accomplishment of the specified milestones and project completion.

B. It shall also include, but not be limited to:
   1. A justification and identification of activities that were worked out of sequence.
   2. A description of problem areas.
   3. Current and/or anticipated delaying factors and their potential impact.
   4. An explanation of corrective action (recovery plan) either taken or proposed for all critical areas.
   5. A listing of all intermediate contractual milestones with their respective float and schedule analysis.
   6. Define activities that were not started or completed as scheduled and provide explanation.
   7. Identify and discuss planned manpower versus actual manpower usage and provide projections by Subcontractor.
   8. Identify outstanding “Requests for Information (RFI’s)” and discuss their schedule impact.

1.6 MAN-HOURS LOADING REPORTS

A. After acceptance of the original Progress Schedule, assign labor resources to each construction activity within each responsibility code in man-hours. Resource schedule reports will be required and resource leveling may be employed as required.

1.7 PROGRESS SCHEDULE SUBMITTAL

A. No later than 10 calendar days after the Notice to Proceed, submit to the ENGINEER a 90-day Bar Chart Schedule. During this period CONTRACTOR and the Scheduling Consultant shall meet with the ENGINEER and the OWNER for a minimum of 1 - day workshop sessions to review technical requirements and schedule development methods and procedures. The 90-day Bar Chart Schedule will be reviewed by the ENGINEER within 7 calendar days of receipt or request for adjustment. A meeting, or meetings, may be required with CONTRACTOR’S Scheduling Consultant during this period in order to expedite acceptance or adjustment. Any adjustments required after this period shall be made and resubmitted by CONTRACTOR within 7 calendar.

B. No later than 30 calendar days after the Notice to Proceed, 7 calendar days after the
complete Progress Schedule has been accepted by the ENGINEER, CONTRACTOR submit to the ENGINEER a full Progress Schedule prepared in accordance with Articles 1.1 through 1.5, above. During this period the ENGINEER, CONTRACTOR and CONTRACTOR’S Scheduling Consultant shall meet biweekly to review the progress of the development of the full Progress Schedule. Lack of progress in the development of the Progress Schedule shall be cause for suspension of any Progress Payment. The complete Progress Schedule will be reviewed by the ENGINEER within 7 calendar days of receipt or request for adjustment. A meeting, or meetings, may be required with CONTRACTOR’S Scheduling Consultant during this period in order to expedite acceptance or adjustment. Any adjustments required after this period shall be made and resubmitted by CONTRACTOR within 7 calendar days.

C. No later than 7 calendar days after the complete Progress Schedule has been accepted by the ENGINEER, CONTRACTOR submit to the ENGINEER a CPM Progress Schedule with man-hours in accordance with Articles 1.4 and 1.6, above. The Progress Schedule shall be reviewed by the ENGINEER within 7 calendar days of receipt or request for adjustment. Any adjustments required after this period shall be made and resubmitted by CONTRACTOR within 7 calendar days.

D. If, in the preparation of the Progress Schedule, CONTRACTOR reflects a completion date or milestone date different than that specified in the Contract, this in no way voids the dates set therein. The dates as specified in the Contract govern. Where the Progress Schedule reflects a completion date or milestone date earlier than specified, the ENGINEER may accept such schedule with CONTRACTOR specifically understanding that no claim for additional Contract Time or compensation shall be brought against the OWNER as the result of failure to complete the Work by the earlier date shown on the Progress Schedule.

1.8 FAILURE TO SUBMIT

A. Should CONTRACTOR fail to submit the Progress Schedule in the form indicated within the required time frames shall be cause for suspension of any Progress Payment.

1.9 UPDATING THE PROGRESS SCHEDULE

A. Updates:
   1. Monthly updates to the mathematical tabulation are the CONTRACTOR’S responsibility. The updated mathematical tabulation shall include the following data for each activity:
      a. Actual start date (for started activities).
      b. Actual finish date (for completed activities).
      c. Percent complete.
d. Current projected early/late start/finish dates (for activities not started).
e. Current early/late finish dates (for uncompleted activities).
f. Current Total float.
g. Critical path activities noted.

2. CONTRACTOR’S Schedule Update shall include a narrative report which shall include a description of the current progress/status of each area of the project, a description of the progress for the period, a description of the critical path, a discussion of current or potential delays, Change Orders (pending or approved), or other problems.

3. Provide the ENGINEER with five updated hard copies of schedule data and two software backup copies on CD’s. Network diagrams shall be submitted with the tabulation if there are any proposed revisions to network logic, interim milestones, contract completion, or as directed by the ENGINEER. The updated tabulations shall reflect the current status of activities, as outlined on the baseline network diagram. The updated tabulation reports shall reflect all changes in dates, remaining durations, and float time. If any delays have occurred, these shall be noted for time consideration.

B. Monthly Schedule Meeting:
1. Recording the start and completion dates of each scheduled work activity with the remaining duration for activities started but not completed, including procurement activities is the CONTRACTOR’S responsibility. On one day each month, at least one week prior to the monthly progress meeting, CONTRACTOR and the Scheduling Consultant shall meet with the ENGINEER to tour the site and review and updated information gathered by CONTRACTOR during the month. After acceptance of CONTRACTOR’S updated data, CONTRACTOR’S Scheduling Consultant shall use this information to update the mathematical tabulations and to generate a Monthly Schedule Update.

C. Network Revisions:
1. Conditions may develop that require revisions to logic or durations of the original network. If during the progress of the Work events develop that necessitate changes in the original Progress Schedule, propose such changes so as to depict the current mode of operation and provide the ENGINEER with a revised network diagram. Any revision to the original logic or original durations must be accepted by the ENGINEER, in writing. After acceptance, logic/duration revisions will be incorporated into the Progress Schedule and will be addressed in the monthly narrative report by means of both a description of the revisions and a listing of those network elements affected by such change. All changes resulting from Change Order(s), additions or deletions, will be fully incorporated into the Progress Schedule on the first update after the Change Order approval, including all adjustments to the man-hours.
2. Revisions and additions to the accepted network diagrams and mathematical tabulations shall be submitted in three (3) copies of the reports, two (2) software back-up copies on CD of the schedule and a reproducible set of the 24-inch by 36-inch pure logic diagrams.

3. The list of revisions and additions will include the following, when applicable:
   a. Addition and deletion of activities.
   b. Addition and deletion of relationships.
   c. Changes to activity descriptions and durations.
   d. Changes to relationship types and lag codes.
   e. Changes to contract milestone dates and approved constraint dates.
   f. Changes to dollar values resulting from approved Change Orders.
   g. All other revisions to the network logic.

1.10 TIME IMPACT ANALYSIS FOR CHANGE ORDERS, DELAYS, AND TIME EXTENSIONS

A. Change Orders, Delays, and Time Extensions:
   1. When a Change Order(s) is (are) proposed by the ENGINEER or CONTRACTOR, or delays are experienced, submit a Time Impact Analysis (TIA) illustrating the influence of each Change Order or delay on any specified intermediate milestone date(s) or contract completion date. Each TIA shall include a sketch (fragnet) demonstrating how CONTRACTOR proposes to incorporate the change(s) or delay(s) into the current Progress Schedule. The fragnet will include all logic changes and additions required as a result of said Change Order(s) or delay(s).

   2. This fragnet will show all CPM Logic revisions for the Work in question and its relationship to other activities in the network plan. Additionally, the analysis shall demonstrate the time impact, based on the date the change was given to CONTRACTOR, the status of construction at that point in time, and the activity duration of all affected activities. The activity duration used in this analysis shall be those included in the latest update of the Progress Schedule, closest to the time of delay as adjusted by mutual agreement in writing.

B. Submission:
   1. Each Time Impact Analysis shall be submitted within 10 calendar days after a delay occurs or a notice of change or Change Order is given to CONTRACTOR. In cases where CONTRACTOR does not submit a Time Impact Analysis for a specific change or delay within the specified period of time, it shall be mutually agreed that no time extension is required.

C. Evaluation:
   1. Final evaluation of each Time Impact Analysis by the ENGINEER shall be made within 7 calendar days after receipt, unless subsequent meetings and negotiations are necessary. Adjustments in the Contract time for performance
shall be made only by written Change Order. Upon acceptance by the ENGINEER, fragment illustrating the influence of changes and delays shall be incorporated into the current schedule by CONTRACTOR during the first update after agreement is reached.

2. The time difference between the Early Finish date and the Late Finish date is defined as “float.” The “float” belongs to the Project and may be used by CONTRACTOR or the OWNER to benefit the Project. Changes or delays that influence activities in the network with “float” and do not extend the Critical Path (the sequence of activities with zero days float) shall not be justification for an extension of Contract time for performance.

1.11 RECOVERY SCHEDULE

A. In the event that the Progress Schedule update mathematical analysis indicates that the Project, or progress towards any interim milestone requirement, falls 20 or more work days behind schedule and there is no excusable delay or change to support a time extension, prepare and submit a Recovery Schedule for acceptance by the ENGINEER. Also, revise logic or durations to cause the mathematical analysis to show the Project on schedule. The Recovery Schedule shall be submitted five (5) calendar days after the Progress Schedule Update is submitted.

B. Provide additional manpower, equipment, or materials or work additional shifts, or expedite procurement to complete activities within the accepted intermediate or Contract completion dates, at no additional cost the OWNER. Upon acceptance of the Recovery Schedule by the ENGINEER, incorporate the Recovery Schedule into the current Progress Schedule.

C. Lack of Action:
   1. CONTRACTOR’S refusal, failure, or neglect to take appropriate recovery action or to submit a written recovery statement shall constitute reasonable evidence that CONTRACTOR is not prosecuting the Work, or separable part, with the diligence that will ensure its completion within the applicable Contract time. Such lack of action shall constitute sufficient basis for the ENGINEER to recommend the withholding of some or all of any payment due, or shall be considered grounds for termination by the OWNER.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++
SECTION 01330

SUBMITTALS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Submittal of documents described in the General Conditions, Supplementary Conditions and hereinafter are required prior to, during and at the end of the construction period. The submittals shall conform to the requirements described in this Section and all referenced Sections or Articles.

1.2 GENERAL SUBMITTAL REQUIREMENTS

A. A submittal shall be made for each complete system. Piecemeal submittals will not be accepted.
B. Submittals requiring ENGINEER review only will be processed within 15 calendar days after receipt from CONTRACTOR. Submittals requiring ENGINEER and OWNER review will be processed within 30 calendar days after receipt from CONTRACTOR.
C. CONTRACTOR shall maintain a file of all approved submittal documents at the work site.
D. CONTRACTOR shall show his executed internal review and approval marking. Submittals which are received from sources other than through CONTRACTOR’S Office or which have not undergone CONTRACTOR review will be returned “Rejected”.

1.3 PROCEDURE

A. Submittals within 10 days after the Notice to Proceed: Submit the following items within 10 days after the Notice to Proceed. Location of information concerning each submittal is referenced and a copy of each required form is included in Section 01331, Reference Forms.
   1. Preliminary Schedule of Values: Prepare and submit in accordance with Section 01291, Schedule of Values.
   2. Preliminary Schedule of Shop Drawings and Sample Submittal in accordance with the General Conditions and Section 01332, Shop Drawing Procedures.
   3. Preliminary Progress Schedule: Prepare and submit in accordance with Section 01321, Progress Schedule.
B. Submittal within 30 days after the Notice to Proceed: Submit the following items within 30 days after the Notice to Proceed. Location of information concerning each
The submittal is referenced and a copy of each required form is included in Section 01331, Reference Forms.

1. Schedule of Values: Prepare and submit in accordance with Section 01291, Schedule of Values.
2. Submittal Schedule: Prepare and submit schedule of all Shop Drawings in accordance with Section 01332, Shop Drawing Procedures.
3. Monthly payment schedule.
4. Maintenance of Plant Operations Schedule, in accordance with Section 01143, Coordination with OWNER’S Operations.
5. Ninety-day Bar Chart Schedule: Prepare and submit a 90-day Bar Chart Schedule within 20 days, in accordance with Section 01324, Progress Schedule.

C. Submit the following items within 40 days after the Notice to Proceed. Location of information concerning each submittal is referenced and a copy of each required form is included in Section 01331, Reference Forms.

1. Progress Schedule: Prepare and submit a Progress Schedule within 40 days, in accordance with Section 01321, Progress Schedule.

D. Submit the following items at the Pre-construction Conference: Refer to Sections 01332, Shop Drawing Procedures, and Section 01521, ENGINEER’S Field Office.

E. Submittals Prior to Beginning the Work: Refer to the General Conditions and Supplementary Conditions of the Contract Documents.

F. Submittals During Construction: During progress of the construction, provide the following submittals in a timely manner to prevent any delay in the Work schedule:

1. Updates to Progress Schedule: Provide an assessment of Work progress in relation to the Progress Schedule in accordance with Section 01321, Progress Schedule.
2. Shop Drawings, Product Data and Samples: Submit Shop Drawings, product data and samples in accordance with Section 01332, Shop Drawing Procedures, and as required in various Sections of the Contract Documents.
3. Progress Payments: Submit applications for partial payments as specified in the General Conditions.
4. Request for Information: Submit a Request for Information (RFI), included in Section 01331, Reference Forms, when any of the following are required: an interpretation of the Specifications; additional details; information not shown on the Drawings or in the Specifications; or clarification of discrepancies is needed. Retain one copy and submit 2 hard copy and 1 electronic PDF format copy to the ENGINEER for response. Once the RFI is commented on by the ENGINEER, an electronic PDF format copy will be forwarded to the OWNER.
5. Change Orders: Forms shown in Section 01331, Reference Forms. A proposal for a Change Order may be submitted by CONTRACTOR in accordance with the General Conditions. The Change Order Proposal included in Section 01331,
Reference Forms, must be in writing and must include sufficient information to assess the need for a change in the Work, the Contract time or the Contract amount. Whenever the ENGINEER determines the need for a Change Order, a Request for Change Order Proposal Form included in Section 01331, Reference Forms, will be issued to CONTRACTOR. Upon receipt of a Request for Change Order Proposal Form or when CONTRACTOR determines the need for a Change Order, prepare and submit three copies of a Change Order Proposal. The Change Order Proposal must be approved by CONTRACTOR, ENGINEER, and OWNER. When a Change Order Proposal has been accepted, a Work Change Directive shall be submitted. Each Work Change Directive shall include a Change Order Pricing Sheet, included in Section 01331, Reference Forms. After the Work Change Directive has been accepted by the OWNER, a Change Order included in Section 01331, Reference Forms, will be prepared and executed. Not authorized to begin work on a Change Order until it is fully executed. Any Work done by CONTRACTOR prior to execution of a Change Order is entirely at his own risk.

6. CONTRACTOR’S Daily Report: Shown in Section 01331, Reference Forms: Submit four copies of CONTRACTOR’S Daily Report. CONTRACTOR and each subcontractor shall prepare and submit a daily report on forms shown in Section 01331, Reference Forms. The report shall contain, as a minimum, information on the location and description of the Work being performed, size, quantity and description of materials and equipment installed or delivered, coordination or scheduling concerns, requests for clarifications, and any discrepancies noted in the Contract Documents or on the as-built conditions. The report shall also contain CONTRACTOR’S daily workforce count by craft, general weather conditions, any Work performed other than during established working hours, and any other pertinent items relative to the Work, and as required by ENGINEER. The report is due at the ENGINEER’S office by 9:00 a.m. on the following Work day and shall be signed by a responsible member of CONTRACTOR’S staff.

7. Submittal Schedule: Shown in Section 01331, Reference Forms. Submit an updated Shop Drawing, Product Data and Sample Submittal Schedule with each Progress Payment Request. Three updated Submittal Schedules shall be submitted with each month’s Progress Payment Request.

8. Construction Photographs: Submit Construction Photographs and Aerial Photographs with each month’s Progress Payment Request as specified in Section 01323, Construction Photographs.

9. Operation and Maintenance Manuals and Lesson Plans: Submit Equipment Operation and Maintenance Manuals for approval, by the ENGINEER, within 30 days after approval of Equipment Shop Drawing. Submit Equipment Training Lesson Plans for approval, by the ENGINEER, 60 days prior to commencement of training. Submit Operation and Maintenance Data and Lesson Plans in accordance with Section 01781, Operation and Maintenance Data and Section 01821, Instruction of Operations and Maintenance Personnel.
10. Submit test procedures for Start up, Burn-in, Field Operations Checks and Commissioning a minimum of 20 days prior to commencement of the first scheduled test date. The CONTRACTOR should allow up to 7 days for ENGINEER’S review.

G. Submittal at Substantial Completion: Submit all Operations and Maintenance Data for each item of Work commissioned into operation.

H. Submittal At Project Closeout: With a written Notice of Completion, submit the following items in the proper form as a condition of Final Acceptance of the Work:
   1. Project Record Documents: Submit in accordance with Section 01782, Record Documents.
   2. Guarantees, Warranties and Bonds: Submit as required in the General Conditions and listed in various Sections of the Specifications, and Section 01781, Operation and Maintenance Data.
   3. Operations and Maintenance Data: Submit all remaining product data, field test data and manuals as specified in various Sections of the Specifications, and Section 01781, Operation and Maintenance Data.
   4. Survey notes.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++
Form 01330-A

SCHEDULE OF VALUES

Sheet ______ of ________

Section No. ______________

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Gentlemen:

WHEREAS, __________________________, a(n) (Name of State) Corporation, is required to execute documents which are necessary for the prompt and efficient execution of the corporate business:

NOW, THEREFORE, BE IT RESOLVED, (by the Board of Directors of the Corporate Name), that the name of parties listed below be authorized to execute and sign on behalf of said corporation the following documents:

1. The Proposal
2. The Contract
3. The Bond
4. Payrolls
5. Claims
6. Change Orders
7. Application for Payment
8. Work Change Directives
9. All other papers necessary for the corporation’s affairs and the execution of the contract.

The powers and duties herein granted shall be and is hereby granted for the duration of the contract for the construction of the __________________________ Project No. __________, or until express notice of revocation has been duly given in writing, whichever is the lesser period.

Dated and passed by the Board of Directors this ______ day of ______, 20__.

NAME  SIGNATURE  TITLE  DOCUMENTS

I, ____________________________, of the __________________________ Corporation, do hereby certify that the above is a true and correct copy of a resolution adopted by the Board of Directors of said corporation, at a meeting of said board held on ____________, day of ______, 20__, and that the same is in full force and effect at this time.

(Seal of Corporation)

STATE OF ____________________________________________

COUNTY OF _________________________________________

This instrument was acknowledged before me this ______ day of ________, 20__

By ____________________________, appearing before the undersigned Notary Public, and stated that he executed such instrument on behalf of said corporation for the purpose and consideration therein expressed.

My Commission Expires: ____________________________

(Seal of Notary Public)

91st Avenue WWTP Sludge Solar Drying Beds 01330-C 01/28/17
# APPLICATION FOR PAYMENT

To: Project Manager  
200 W. Washington Street, 8th Floor  
Phoenix, Arizona 85003  

<table>
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<th>Project No.</th>
<th>Project Name</th>
<th>Contract No.</th>
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**ATTACHMENTS: SCHEDULE OF VALUES**

**GROSS AMOUNT DUE:** $xx,xxx,xxx.xx

- **RETAINAGE - 10%** $xx,xxx,xxx.xx
- **SECURITIES - 10%** $xx,xxx,xxx.xx

**NET AMOUNT DUE TO DATE:** $xx,xxx,xxx.xx

**LESS AMOUNT PREVIOUSLY PAID:** $xx,xxx,xxx.xx

**AMOUNT DUE THIS APPLICATION:** $xx,xxx,xxx.xx
CERTIFICATION OF CONTRACTOR: I certify that all items and amounts shown on the face of this Application for Payment are correct, that to the best of my knowledge and belief, all work has been performed and/or material supplied in full accordance with the requirements of the referenced contract, and/or duly authorized deviations, substitutions, alterations, and/or additions; that the foregoing is true and correct statement of the contract account up to and including the last day of the period covered by this Application that no part of the "Amount Due This Application" has been received, and that the undersigned and subcontractors have: (check applicable line).

a. Complied with all labor provisions of said contract.

b. Complied with all the labor provisions of said contract except in those instances where a dispute exists with respect to said labor provisions. (If "b" is checked, include attachment briefly describing nature of dispute.)

Contractor Representative __________________________ Date ____________

Title __________________________

CERTIFICATION OF ENGINEER: I certify that all work described was inspected, and that to the best of my knowledge and belief the work was performed and/or supplied in full accordance with the requirements of this contract.

Resident Project Representative __________________________ Date ____________

I certify that I have checked and verified the above and foregoing Application for Payment; that to the best of my knowledge and belief it is a true and correct statement of work performed and/or material supplied by the contractor; that all work and/or material included in this Application has been inspected and that it has been performed and/or supplied in full accordance with the requirements of the referenced contract, and that payment claimed and requested by the Contractor is correctly computed on the basis of work performed and/or material supplied to date.

Project Manager/Engineer __________________________ Date ____________

Firm __________________________

CITY USE ONLY BELOW THIS LINE

RECOMMENDED BY: __________________________ Date ____________

APPROVED BY: __________________________ Date ____________

Project Manager __________________________

Superintendent __________________________
CITY OF PHOENIX: Water Services Department
PROJECT NAME: 91st Avenue WWTP Sludge Solar Drying Beds
PROJECT NUMBER: WS90100098

CONTINUATION OF APPLICATION FOR PAYMENT
PROGRESS PAYMENT NO. 1

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COP GUIDE SPEC 01330-D 11/30/17
REQUEST FOR CHANGE ORDER PROPOSAL

Date: ________________

CONTRACTOR ______________________________

______________________________

______________________________

NOTICE TO CONTRACTOR: Please submit a Change Order Proposal for the proposed modifications to the Contract Documents as described below. If acceptable, a Change Order will be issued to authorize the work. THIS IS NOT A CHANGE ORDER FOR AUTHORIZATION TO PROCEED WITH THE WORK AS DESCRIBED!

SCOPE OF WORK:
Dear Sir:

Certain items of extra work have been found necessary which are not covered by the Contract for the above referenced Project. Therefore, we submit the following amounts as the basis of compensation for such extra work:

JUSTIFICATION:

The Contract completion time will be (increased)(decreased) ____ consecutive calendar days.

Total Cost of Extra Work Covered by Above: $_______
Previously Approved Extra Work: $_______
Original Contract Amount $_______

TOTAL: $_______

By: ________________________________

Title: ________________________________

CONTRACTOR: ________________________________
IN ACCORDANCE WITH THIS CONTRACT, THE FOLLOWING CHANGE IS ORDERED.

DESCRIPTION:

Γ AUTHORIZATION FOR WORK DESCRIBED HEREIN TO PROCEED ON A NEGOTIATED COST BASIS.

Γ AUTHORIZATION FOR WORK DESCRIBED HEREIN TO PROCEED ON A TIME AND MATERIALS BASIS.

COST:

NET AMOUNT OF THIS WORK CHANGE DIRECTIVE = $ ________________

THE ENGINEER HAS REVIEWED THE COST FOR THIS WORK CHANGE DIRECTIVE AND CONSIDERS IT REASONABLE FOR THE LABOR AND MATERIAL NECESSARY TO COMPLETE THE WORK.

CONTRACT TIME:  Γ INCREASE BY _____ DAYS.  Γ NO CHANGE.

RECOMMENDED BY: _______________________________ DATE: _______

ENGINEER

ACCEPTED BY: _______________________________ DATE: _______

CONTRACTOR

APPROVED BY: _______________________________ DATE: _______

OWNER

91st Avenue WWTP Sludge Solar Drying Beds  01330-H  01/28/17
## Description of Work:

Prepared by: 
Date: 

### Project: WS90100098

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<td>5</td>
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<td>$0.00</td>
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<tr>
<td>6</td>
<td></td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
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<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
</tbody>
</table>

**COLUMN SUBTOTALS**

Total: $0.00 $0.00 $0.00 $0.00 $0.00 $0.00 $0.00 $0.00 $0.00 $0.00 $0.00 $0.00 $0.00 $0.00

### Notes:

11.4.1 Labor Rates:

<table>
<thead>
<tr>
<th>Wage Rate</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base Hourly</td>
<td>$0.00</td>
</tr>
<tr>
<td>Subcontract</td>
<td>$0.00</td>
</tr>
</tbody>
</table>

**TABLE 1 - Labor Rates**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
<th>Measure</th>
<th>Unit Cost</th>
<th>Material Cost</th>
<th>Equipment Cost</th>
<th>Supplemental Cost</th>
<th>Labor Cost</th>
<th>Material Cost</th>
<th>Equipment Cost</th>
<th>Supplemental Cost</th>
<th>Subcontract Cost</th>
<th>Subtotal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
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<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
</tbody>
</table>

**COLUMN TOTALS**

Total: $0.00 $0.00 $0.00 $0.00 $0.00 $0.00 $0.00 $0.00 $0.00 $0.00 $0.00 $0.00 $0.00 $0.00

**SUBTOTAL CHANGE ORDER AMOUNT**

$0.00

**ADJUSTMENTS**

1. See Contract General Conditions Article 11
2. Review Change Order PRICING SHEET for Subcontract work listed above and exceeding $500

**GRAND TOTAL CHANGE ORDER AMOUNT**

$0.00

CITY OF PHOENIX - WATER SERVICES DEPARTMENT
PROJECT: WS90100098

01331-I CHANGE ORDER PRICING SHEET

COP STD SPEC

01331-15

02/28/02
CITY OF PHOENIX: Water Services Department
PROJECT NAME: 91st Avenue WWTP Sludge Solar Drying Beds
PROJECT NUMBER: WS90100098

Form 01330-J
CHANGE ORDER

CITY OF PHOENIX
WATER SERVICES DEPARTMENT
CONSTRUCTION MANAGEMENT DIVISION

CONTRACT CHANGE ORDER NO. X

<table>
<thead>
<tr>
<th>PROJECT NUMBER</th>
<th>PROJECT TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>WSXXXXXXXXX-1</td>
<td>91st Avenue WWTP Sludge Solar Drying Beds</td>
</tr>
</tbody>
</table>

In accordance with this contract, the following change is ordered, resulting in: (Check all that apply).

- Increase in Contract Amount  
- No Change in Contract Amount  
- Decrease in Contract Amount
- Increase in Contract Time  
- No Change in Contract Time  
- Decrease in Contract Time

DESCRIPTION:

COST: $__________

Notice to Proceed Date:  
Original Contract Completion Date:  
Adjusted Contract Completion Date:  

We, the undersigned, have given careful consideration to the change proposed, and hereby agree, if this proposal is approved, that we will provide all equipment, furnish all materials, except as may otherwise be noted above, and perform all services necessary for the work specified, and will therefore, accept as full payment, the fees or prices and adjustments in contract time shown above. This Change Order includes all direct costs such as labor, material, job overhead, profit, costs for modifications or changes in sequence of work to be performed, delays, rescheduling, disruptions, extended direct overhead or general overhead, acceleration, material or other escalation which include wages and other impact costs.

REVIEWED BY:  
RECOMMENDED BY:  
ACCEPTED (Contractor):

COMPANY/FIRM:  
NAME OF CONTRACTOR

SIGNATURE:  
TITLE:  
DATE:

PREPARED BY:  
PROJECT MANAGER

91st Avenue WWTP Sludge Solar Drying Beds
01330-J  01/28/17
### Form 01330-K

**REQUEST FOR INFORMATION**

<table>
<thead>
<tr>
<th>CONTRACTOR</th>
<th>RFI#</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requested By</td>
<td>Directed to</td>
</tr>
<tr>
<td>Subject</td>
<td>Date Received</td>
</tr>
<tr>
<td>Spec. Section</td>
<td>Date Transmitted</td>
</tr>
<tr>
<td>Drawing References</td>
<td>Date Reply Received</td>
</tr>
<tr>
<td>Date Reply Needed</td>
<td>Date Reply Transmitted</td>
</tr>
</tbody>
</table>

**INFORMATION NEEDED:**

Date __________________ Signature __________________

**REPLY:**
<table>
<thead>
<tr>
<th>CONTRACTOR</th>
<th>RFA#</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requested By</td>
<td>Directed to</td>
</tr>
<tr>
<td>Subject</td>
<td>Date Received</td>
</tr>
<tr>
<td>Spec. Section</td>
<td>Date Transmitted</td>
</tr>
<tr>
<td>Drawing References</td>
<td>Date Reply Received</td>
</tr>
<tr>
<td>Date Reply Needed</td>
<td>Date Reply Transmitted</td>
</tr>
</tbody>
</table>

REQUESTED ALTERATION:

Date ____________________ Signature ____________________

REPLY:

Date ____________________ Signature ____________________
Form 01330-M

CONTRACTOR’S DAILY CONSTRUCTION REPORT

CONTRACTOR

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Project No.</th>
<th>Report No.</th>
<th>Date</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>CONTRACTORS WORK FORCE</th>
<th>SUBCONTRACTORS WORK FORCE</th>
<th>EQUIPMENT ON SITE:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administrative</td>
<td>Mechanical</td>
<td>Cranes</td>
</tr>
<tr>
<td>Supervisors</td>
<td>Electrical</td>
<td>Loaders</td>
</tr>
<tr>
<td>Carpenters</td>
<td>Site work</td>
<td>Dozers</td>
</tr>
<tr>
<td>Iron Workers</td>
<td>Masonry</td>
<td>Scrapers</td>
</tr>
<tr>
<td>Operators</td>
<td>Roofing</td>
<td>Compactors</td>
</tr>
<tr>
<td>Finishers</td>
<td>Rebar</td>
<td>Compressors</td>
</tr>
<tr>
<td>Welders</td>
<td>Foundation</td>
<td>Welders</td>
</tr>
<tr>
<td>Electricians</td>
<td>Painting</td>
<td>Graders</td>
</tr>
<tr>
<td>Laborers</td>
<td></td>
<td>Trucks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Backhoe</td>
</tr>
</tbody>
</table>

Work Performed: 

Material and Equipment Delivered: 

Remarks: 

By: ____________________

91st Avenue WWTP Sludge Solar Drying Beds 01330-M 01/28/17
Form 01330-N

TV INSPECTION REQUEST

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

DATE: ____________________________ REQUESTOR: ________________

PHONE #: ________________________

LOCATION: ________________________________

REASON FOR INSPECTION: ________________________________

Q.S.: ________________________________

(PLEASE PROVIDE COPY OF SECTION TO BE INSPECTED)

LINEAL FT. TO INSPECT: ______________

C/O-MH#: ___________________________ TO C/O-MH#: _________________________

PIPE DIAM.: __________________________

PIPE TYPE: __________________________

DEPTH OF FLOW: ______________________ IN.

MH DEPTH: __________________________

DATE WHEN LAST CLEANED: MH=S: ______________________ MAIN: ______________

COMMENTS: ____________________________________________________________________

_____________________________________________________________________________

_____________________________________________________________________________

_____________________________________________________________________________

FOR TV SECTION ONLY

DATE RECEIVED: __________________________

ASSIGNED TO: __________________________ DATE: ________ EQUIP: _________

COMPLETED: __________________________ DATE: __________

COMMENTS: ____________________________________________________________________

_____________________________________________________________________________
Form 01330-O

CONTRACTOR SUBMITTAL REVIEW CHECKLIST

Contractor shall provide the completed review checklist with submittal to engineer. Submittals provided to the engineer without the completed checklist shall be rejected.

<table>
<thead>
<tr>
<th>Item</th>
<th>Review Description</th>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Submittal Meets Requirements per Specification 01330</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>2</td>
<td>Submittal Meets Requirements of Referenced Specification Sections</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>3</td>
<td>If Submittal is a Shop Drawing Check Form 01332-B is Attached</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>4</td>
<td>If Submittal is an O&amp;M Manual Check Form 01781 is Attached</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

Contractor
Certify either A or B:

____ A. We have verified that the material or equipment contained in this submittal meets all the specified requirements, including coordination with all related work. (no exceptions).

____ B. We have verified that the material or equipment contained in this submittal meets all the requirements specified except for the attached deviations.

No. | Deviation
--- | ---

CONTRACTOR’S SIGNATURE: ____________________________ DATE ____________

91st Avenue WWTP Sludge Solar Drying Beds 01330-O 01/28/17
Form 01330-P

SUBMITTAL REVIEW FORM

(Company Name)  
Address:  
Phone:  
FAX:  

WS#  
CONTRACT #

Submittal Review

<table>
<thead>
<tr>
<th>Project Title:</th>
<th>Submitting Firm:</th>
<th>Received Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facility:</td>
<td>Reviewer:</td>
<td>Reviewed Date:</td>
</tr>
<tr>
<td>Submittal Title:</td>
<td>Reviewer Phone:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ITEM</th>
<th>SPEC/DWG REFERENCE</th>
<th>COMMENT</th>
<th>RESPONSE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Additional comments: (your remarks here)

Response Column:
- Inc. - Incorporated verbatim
- Inc. / Edit – Incorporated with modification – include explanation of modification
- N/I – Not Incorporated – include explanation

91st Avenue WWTP Sludge Solar Drying Beds 01330-P 01/28/17
SECTION 01331

REFERENCE FORMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section contains the required forms for CONTRACTOR use in documenting testing Work and other Work required under this Contract. This Section supplements but does not supersede specific testing requirements found elsewhere in the Contract Documents.

B. The forms listed below are included in this Section are referenced from other Sections in the Contract Documents. Forms will include, but will not necessarily be limited to the list below. The forms provided indicate minimum requirements. If desired to use a supplemental form the document must be submitted for review and approval by the ENGINEER.

<table>
<thead>
<tr>
<th>Form No.</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>00800-A</td>
<td>Certificate of Substantial Completion</td>
</tr>
<tr>
<td>00800-B</td>
<td>Contractor’s Affidavit Regarding Settlement of Claims</td>
</tr>
<tr>
<td>01143-A</td>
<td>Extended Construction Work Hours Permit Application</td>
</tr>
<tr>
<td>01330-A</td>
<td>Schedule of Values</td>
</tr>
<tr>
<td>01330-B</td>
<td>Shop Drawings, Product Data and Sample Submittal Schedule</td>
</tr>
<tr>
<td>01330-C</td>
<td>Authorized Signatures Form</td>
</tr>
<tr>
<td>01330-D</td>
<td>Application for Payment</td>
</tr>
<tr>
<td>01330-F</td>
<td>Request for Change Order Proposal</td>
</tr>
<tr>
<td>01330-G</td>
<td>Change Order Proposal</td>
</tr>
<tr>
<td>01330-H</td>
<td>Work Change Directive</td>
</tr>
<tr>
<td>01330-I</td>
<td>Change Order Pricing Sheet</td>
</tr>
<tr>
<td>01330-J</td>
<td>Change Order</td>
</tr>
<tr>
<td>01330-K</td>
<td>Request for Information</td>
</tr>
<tr>
<td>01330-L</td>
<td>Request for Alteration</td>
</tr>
<tr>
<td>01330-M</td>
<td>Contractor’s Daily Construction Report</td>
</tr>
<tr>
<td>01330-N</td>
<td>TV Inspection Request</td>
</tr>
<tr>
<td>01330-O</td>
<td>Contractor Submittal Review Checklist</td>
</tr>
<tr>
<td>01330-P</td>
<td>Submittal Review Form</td>
</tr>
<tr>
<td>01332-A</td>
<td>Submittal Transmittal Form</td>
</tr>
<tr>
<td>01332-B</td>
<td>Shop Drawing Review Checklist</td>
</tr>
<tr>
<td>01600-A</td>
<td>Equipment Information Form Instructions</td>
</tr>
</tbody>
</table>
PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++
SECTION 01332

SHOP DRAWING PROCEDURES

PART 1 - GENERAL

1.1 DESCRIPTION

A. The submittal of Shop Drawings shall conform to requirements of General Conditions and procedures described in this Section. A separate transmittal form shall be used for each specific item or class of material or equipment for which a submittal is required. Transmittal of Shop Drawings on various items using a single transmittal form shall be permitted only when the items taken together constitute a manufacturer’s “package” or are so functionally related that expediency indicates review of the group or package as a whole.

B. The term “Shop Drawings” as used herein shall be understood to include detailed design calculations, fabrication and installation drawings, lists, graphs, test data, operating instructions, and other items which shall include, but are not necessarily limited to:

1. Drawings and catalog information and cuts.
2. Specifications, parts list, suggested spare parts lists, and equipment drawings.
3. Wiring diagrams of systems and equipment.
4. Complete lubrication, maintenance and operation instructions, including initial startup instructions as described in Section 01821, Instruction of Operations and Maintenance Personnel.
5. Applicable certifications.
6. Anchor bolt templates, mounting instructions and mounting design calculations as required.
7. Required maintenance operations to allow all installed equipment to remain idle for a period of time not to exceed 24 months.
8. Other technical, installation, and maintenance data as applicable.
9. Unloading and handling methods and storage requirements.
10. Note, highlight, and explain proposed changes to the Contract Documents.
11. Paint submittal showing type of paint and the mils thickness of coating system used. The coating system shall be the approved system as submitted under Division 9, Finishes.
12. Drawings showing CONTRACTOR field verifications illustrating all field dimensions. Field verify all dimensions and existing materials shown on the Drawings. Any modifications required shall be at CONTRACTOR’S expense.
C. Preliminary Submittal Schedule: CONTRACTOR, within (--1--) days after the Notice to Proceed, shall prepare and submit to the ENGINEER a Preliminary Submittal Schedule. Identify on his Preliminary Submittal Schedule all of the submittal items required by the Contract Documents governing the Work.

D. Submittal Schedule: CONTRACTOR, within 30 days after the Notice to Proceed, shall prepare and submit to the ENGINEER a comprehensive Submittal Schedule. Identify on his Submittal Schedule all of the submittal items required by the Contract Documents governing his Work. Indicate, for each submittal item on his Submittal Schedule the following:

1. The date by which that item will be submitted to the ENGINEER.
2. Whether the submittal is for a substitute or “equal” item. Complete submittal for all substitute or “equal” items shall be made to the ENGINEER, in accordance with the Contract requirements. Identification by the CONTRACTOR of substitute or “equal” items does not relieve CONTRACTOR of his responsibility to furnish equipment and materials that meet all the requirements of the Contract Documents. Items of manufacturers’ equipment listed with CONTRACTOR’S Bid Proposal shall not be replaced with any substitute or “equal” items as part of this Submittal Schedule process. Procedure for substitutions is specified under the General Conditions.
3. Whether the submittal is for review or “for record only”.
4. The date by which response is required.
5. The date by which the material or equipment must be on site in order not to delay the progress of the Work.

E. In preparing his Submittal Schedule, consider the nature and complexity of each submittal item and shall allow ample time for review, revision or correction. Submittal will normally be returned to CONTRACTOR within 15 calendar days following receipt of the submittal. Complex submittals, for example, Instrumentation and Control Systems, Variable Frequency Drives and other such submittals may require additional review time. Identify submittal(s) for which long review periods are anticipated.

F. Hereby notified that the project electric motor requirements, specified in Section 11000, Electric Motors, do not allow standard “off the shelf” motors. Make provisions in the Submittal Schedule to account for longer manufacturing and delivery lead times for the motors and equipment requiring electric motors under this Project.

G. The ENGINEER will review CONTRACTOR’S Submittal Schedule to determine its completeness and compatibility with the Progress Schedule. A Submittal Schedule which is incompatible with the Progress Schedule or a review schedule which places extraordinary manpower demands on the ENGINEER will be sufficient reason(s) to reject the Submittal Schedule. It shall be understood that certain submittals will take
longer than 15 days to review and that these particular submittals will be identified during the review of the Submittal Schedule, by the ENGINEER to allow for very complex submittal reviews. Also, identify submittal for which he anticipates long review periods.

H. CONTRACTOR’S Submittal Schedule shall be consistent with the Progress Schedule as described in Section 01321, Progress Schedule.

I. Approval of the Submittal Schedule shall be required prior to processing of the first progress payment.

J. Submit Shop Drawings for early deliverables items at the Pre-construction Conference. These include, but are not limited to the following:
   1. Decan Pumps
   2. Sump Pumps

1.2 PROCEDURE

A. Submit Shop Drawings to: ENGINEER and OWNER

B. A letter of transmittal shall accompany each submittal. If data for more than one Section of the Specifications is submitted, a separate transmittal letter shall accompany the data submitted for each Section.

C. All letters of transmittal shall be submitted in duplicate.

D. At the beginning of each letter of transmittal, provide a reference heading indicating the following:
   1. OWNER’S Name ____________________________
   2. Project Name ______________________________
   3. Contract No. ______________________________
   4. Transmittal No. ____________________________
   5. Section No. ______________________________

E. If a Shop Drawing deviates from the requirements of the Contract Documents, specifically note each variation in his letter of transmittal.

F. All Shop Drawings submitted for approval shall have a title block with complete identifying information satisfactory to ENGINEER.

(The remainder of this page was left blank intentionally.)
G. All Shop Drawings submitted shall bear the stamp of approval and signature of CONTRACTOR as evidence that they have been reviewed and verified to the completeness of the submittal by CONTRACTOR. Submittal without this stamp of approval will not be reviewed by ENGINEER and will be returned to CONTRACTOR. CONTRACTOR’S stamp contain the following minimum information:

Project Name: __________________________________________________________
CONTRACTOR’S Name: ________________________________________________
Date: __________________
------------------------Reference------------------------
Item: _________________________________________________________________
Specifications:
  Section: __________________
  Page No.: __________________
  Para. No.: __________________
Drawing No.: ________________ of _________________________________
Location: _____________________________________________________________
  Submittal No.: __________________
  Approved By: _______________________________________________________

H. In order to identify and track all submittals as separate and unique items, utilize the submittal identification numbering system as follows:
1. The Submittal Number shall be a separate and unique number correlating to each individual submittal that is required to be tracked as a separate and unique item. The Submittal Number shall be a two part, eight character, alpha/numeric number assigned by CONTRACTOR in the following manner:
   a. The first part of the Submittal Number shall consist of five characters that pertain to the applicable Specification Section number.
   b. The second part of the Submittal Number shall consist of three digits (numbers 001 to 999) to number each separate and unique submittal submitted under each Specification Section.
   c. A dash shall separate the two parts of the Submittal Number.
   d. A typical Submittal Number for the third Working Drawing submitted under Section 15101, Ductile Iron Pipe, would be 15101-003.
2. The Review Cycle shall be a three-digit number indicating the initial submission or resubmission of the same submittal. For example:

   001 = First (initial) submission
   002 = Second submission (first resubmission)
   003 = Third submission (second resubmission)

3. An example of the typical submittal identification numbers for the first submission of the third submittal submitted under Section 15101, Ductile Iron Pipe is:

<table>
<thead>
<tr>
<th>Submittal Number</th>
<th>Review Cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>15101-003</td>
<td>001</td>
</tr>
</tbody>
</table>

An example of the typical submittal identification numbers for the second submission of the third submittal submitted under Section 15101, Ductile Iron Pipe is:

<table>
<thead>
<tr>
<th>Submittal Number</th>
<th>Review Cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>15101-003</td>
<td>002</td>
</tr>
</tbody>
</table>

I. Initially submit to ENGINEER a minimum of 2 HARD copies and 1 Electronic PDF format copies.

J. After ENGINEER completes his review, Shop Drawings will be affixed with a stamp and marked with one of the following notations:
   1. Approved.
   2. Approved as Corrected.
   3. Approved as Corrected, Resubmit.
   4. Revise and Resubmit.
   5. Not Approved.
   7. For Information Only.

K. If a submittal is acceptable, the ENGINEER will mark it “Approved” or “Approved as Corrected” and will forward 1 hard copies and 1 electronic PDF format of the submittal to the OWNER for review and comment. The OWNERS review process will begin when all required copies of a specific submittal are received. After the OWNERS review is complete, the ENGINEERS and OWNERS comments will be combined and --3-- prints or copies of the submittal will be returned to CONTRACTOR.
L. Upon return of a submittal marked “Approved” or “Approved as Corrected”, CONTRACTOR may order, ship or fabricate the materials included on the submittal, provided it is in accordance with the corrections indicated.

M. If a Shop Drawing marked “Approved as Corrected” has extensive corrections or corrections affecting other Shop Drawings or Work, ENGINEER may require that CONTRACTOR make the corrections indicated thereon and resubmit the Shop Drawings for record purposes. Such Shop Drawings will have the notation, “Approved as Corrected - Resubmit.” The corrected Shop Drawing shall be a pre-condition for payment for the work item of the Shop Drawing.

N. If a submittal is unacceptable, 1 copies will be returned to CONTRACTOR with one of the following notations:
   1. “Revise and Resubmit”
   2. “Not Approved”

O. Upon return of a submittal marked “Revise and Resubmit”, make the corrections indicated and repeat the initial approval procedure. The “Not Approved” notation is used to indicate material or equipment that is not acceptable. Upon return of a submittal so marked, repeat the initial approval procedure utilizing acceptable material or equipment.

P. Any related Work performed or equipment installed without an “Approved” or “Approved as Corrected” Shop Drawing will be at the sole responsibility of CONTRACTOR.

Q. Shop Drawings shall be submitted well in advance of the need for the material or equipment for construction and with ample allowance for the time required to make delivery of material or equipment after data covering such is approved. Assume the risk for all materials or equipment which are fabricated or delivered prior to the approval of Shop Drawings. Materials or equipment will not be included in periodic progress payments until approval thereof has been obtained in the specified manner.

R. ENGINEER will review and process all submittals promptly; a reasonable time shall be allowed for this, for the Shop Drawings being revised and resubmitted, and for time required to return the approved Shop Drawings to CONTRACTOR.

S. Responsibility belongs to CONTRACTOR to review submittals made by his suppliers and subcontractors before transmitting them to the ENGINEER to assure proper coordination of the Work and to determine that each submittal is in accordance with CONTRACTOR’S desires and that there is sufficient information about materials and equipment for ENGINEER to determine compliance with the
Contract Documents. Incomplete or inadequate submittals will be returned for revision without review.

T. Furnish required submittals with complete information and accuracy in order to achieve required approval of an item within one submittal. Backcharges for resubmittals that account for a number greater than 20 percent of the total number of first time submittals and will be backcharged for all third submittals. The number of first time submittals shall be equal to the number of submittals agreed to by ENGINEER and CONTRACTOR in accordance with Section 01330.1.2.A.2. All costs to ENGINEER involved with subsequent submittal of Shop Drawings, Samples or other items requiring approval will be backcharged to CONTRACTOR at the rate of 3.0 times direct technical labor cost by deducting such costs from payments due CONTRACTOR for Work completed. In the event that CONTRACTOR requests a substitution for a previously approved item, all of ENGINEER’S costs in the reviewing and approval of the substitution will be backcharged to CONTRACTOR, unless the need for such substitution is beyond the control of CONTRACTOR.

U. The OWNER reserves the right to withhold monies, identified in the General Conditions, for Shop Drawing reviews beyond those described herein.

V. The ENGINEER will implement, if requested by CONTRACTOR, one special Shop Drawing Review Meeting. The purpose of the meeting is to expedite Shop Drawing reviews for the equipment and materials required for the first document of the Work. Requirements of this Section will not be waived, but could be expedited.

W. Mark each page of a submittal and each individual component submitted with the specification number, paragraph, and subparagraph. Arrange submittal information presentation to appear in the sequence in the Specification Section.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)
CITY OF PHOENIX: Water Services Department  
PROJECT NAME: 91st Avenue WWTP Sludge Solar Drying Beds  
PROJECT NUMBER: WS90100098

Form 01332-A

**SUBMITTAL TRANSMITTAL**

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<th>Project No.:</th>
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<td>Contract No.:</td>
</tr>
<tr>
<td>Received By:</td>
<td>Date:</td>
</tr>
<tr>
<td>Provided By:</td>
<td>Transmittal No.:</td>
</tr>
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</table>

**Submittal Type:**  
- [ ] Pre-Construction  
- [ ] Construction  
- [ ] Substantial Completion  
- [ ] Project Close Out

**Submittal Description:**

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**Submittal Review No.:**

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<th>No. Copies</th>
<th>Review Action</th>
<th>Review Comments Attached</th>
<th>Review Check List Attached</th>
<th>Reviewer Initials</th>
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<tr>
<td>Engineer</td>
<td></td>
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Review Action:  
- A - Approved;  
- AC - Approved as Corrected;  
- ACR - Approved as corrected Resubmit  
- RR - Revise and Resubmit;  
- NR - Not Reviewed;  
- NA - Not Approved  
- I - For Information Only

**CONTRACTOR SIGNATURE/DATE**  
**ENGINEER SIGNATURE/DATE**
CITY OF PHOENIX: Water Services Department
PROJECT NAME: 91st Avenue WWTP Sludge Solar Drying Beds
PROJECT NUMBER: WS90100098

Form 01332-B

SHOP DRAWING REVIEW CHECKLIST

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<td>1</td>
<td>Equipment Parts List Provided with Manufacturer Model Number</td>
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<td>5</td>
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CONTRACTOR’S SIGNATURE/DATE: ________________________________            ENGINEER’S SIGNATURE/DATE: ________________________________

91st Avenue WWTP Sludge
Solar Drying Beds                         01332-B                 01/28/17
SECTION 01413

CONTRACTOR’S HAZARDOUS MATERIALS MANAGEMENT PROGRAM

PART 1 – GENERAL

1.1 DESCRIPTION

A. Comply with all Federal, State, and local Laws and Regulations related to environmental protection and environmental safety including, but not limited, to the following:
   2. Title 40 Code of Federal Regulations, Environmental Protections.
   4. State Occupational Safety and Health Administration (OSHA).
   5. Arizona Department of Environmental Quality (ADEQ).
   6. Arizona Department of Water Resources (ADWR).
   7. Maricopa County Air Pollution Control Regulations.

B. In order to ensure the OWNER that CONTRACTOR is complying with the intent of the regulations stated in Paragraph 1.1.A, above, as they relate to the on site use of hazardous materials, hazardous wastes and other substances similarly defined in those regulations, develop and maintain a CONTRACTOR’S Hazardous Materials Management Program that includes as a minimum, but is not limited to the requirements specified herein. The interests of the OWNER are that accidental spills, site contamination, and injury of personnel on the site are avoided. OWNER will not enforce suspected violations of the rules and regulations referenced in Paragraph 1.1.A, above, however the OWNER will notify CONTRACTOR of suspected violations. If in the opinion of the OWNER, CONTRACTOR fails to address the suspected violations in a timely and appropriate manner, OWNER will notify Federal, State, or local regulatory agencies, report the suspected violations to them, and request that they inspect CONTRACTOR’S operations. Any fines that may be levied against OWNER for violations committed on the site by CONTRACTOR, as well as any costs to OWNER associated with cleanup of materials, shall be reimbursed immediately by CONTRACTOR. All documents required by the program shall be made available to the OWNER’S Environmental Representative immediately, upon request.

(The remainder of this page was left blank intentionally.)
C. Responsibility for any hazardous waste, as defined in any of the above listed regulations, and those generated by the CONTRACTOR, belongs to CONTRACTOR. If CONTRACTOR is going to generate, or has generated, a substance that qualifies as a hazardous waste, must obtain an EPA identification number, listing CONTRACTOR’S name and construction site address as the generator of the hazardous waste. Responsibility for the identification, analysis, profiling, transport and disposal of hazardous wastes generated, belongs to CONTRACTOR. The identification number can be obtained from the Arizona Department of Environmental Quality (ADEQ). This number shall be provided to the ENGINEER within 15 days after the Notice to Proceed, or before any hazardous materials are brought onto the site.

1.2 HAZARDOUS MATERIALS PROGRAM REQUIREMENTS

A. Within the regulations listed in Paragraph 1.1.A, above, terms such as hazardous material, hazardous wastes, and similar terms have varying definitions. To dispel confusion regarding what materials fall under the Program Requirements and for the purposes of this Article, Hazardous Material is defined as “any material, whether solid, semi-solid, liquid, or gas, which, if not stored or used properly, may cause harm or injury to persons through inhalation, ingestion, absorption or injection, or which may negatively impact the environment through the use or discharge of the material on the ground, in the water (including groundwater), or to the air.”

B. All chemicals brought onto the site must be approved by OWNER. Prior to bringing any chemical on site, request approval from OWNER’S Environmental Representative for each chemical CONTRACTOR proposes to bring on site. At the time of request, OWNER’S Environmental Representative may request and receive from CONTRACTOR, specific information associated with each chemical. The specific information may include, but is not limited to, MSDS, manufacture, vendor, container size(s), number of containers, minimum and maximum volume of material intended to be stored on site, as well a description to the process or procedures in which any requested chemical is to be used. OWNER, within 7 working days from receipt of the specific chemical information, will inform CONTRACTOR as to whether the chemical has been approved for use on site.

C. Maintain on site two notebooks containing (1) a chemical inventory, and (2) current (dated within the past two years) Material Safety Data Sheets for all materials being used on site, whether or not they are defined as a Hazardous Material in Paragraph 1.2.A, above. One notebook shall be kept in CONTRACTOR’S on-site office and the other shall be kept in a location specified by the OWNER’S Environmental Representative. These notebooks must be kept up-to-date as materials are brought onto and removed from the site. Copies of MSDS sheets for chemicals removed from the site shall be provided to the OWNER’S Environmental Representative.
D. Develop an emergency/spill response plan, for each hazardous material or class/group of materials. As a minimum, the response plan must address the following:

1. Provide a description of equipment on site available to contain or respond to an emergency/spill of the material.
2. Notification procedures.
3. Response coordination procedures between CONTRACTOR, OWNER, and ENGINEER.
4. Provide a Site Plan showing the location of stored hazardous materials and location of spill containment/response equipment.
5. Provide a description of the hazardous material handling and spill response training provided to CONTRACTOR’S employees.

E. In accordance with applicable Laws and Regulations, properly and safely store all hazardous materials, which shall include as a minimum, the following:

1. Have a designated storage site for hazardous materials that includes secondary containment. The site must include barriers to prevent vehicles from colliding with the storage containers and offer protection from environmental factors such as weather.
2. Provide signage in accordance with applicable Laws and Regulations, clearly identifying the hazardous materials storage site.
3. All hazardous materials containers must bear the applicable Hazard Diamonds.

F. Properly label all containers of consumable materials, whether or not they are classified as Hazardous Materials under this Section. The name of CONTRACTOR or subcontractor shall be stenciled on any container containing a hazardous material and on any container over five-gallon capacity containing a non-hazardous material. Any container must have a label clearly identifying the contents. If any such unlabeled containers are discovered on the site, the OWNER’S Environmental Representative will notify CONTRACTOR. Responsibility to remove such containers belongs to CONTRACTOR. Containers will be properly labeled or removed from the site within one hour. Any containers that are filled from larger containers must also be properly labeled.

G. OWNER encourages storage of hazardous materials off site until the materials are needed on site.

H. Provide all documentation required herein available immediately upon request of OWNER’S Environmental Representative. CONTRACTOR’S Safety Representative will meet at least monthly with OWNER’S Environmental Representative to review CONTRACTOR’S Hazardous Materials Management Program documents, procedures, and inspect the storage site and job site to ensure the requirements specified herein are being complied with. Also, provide OWNER’S Environmental Representative and the ENGINEER with copies of all permits obtained from environmental regulatory agencies.
I. Provide documentation to ENGINEER and OWNER’s Environmental Representative that CONTRACTOR, subcontractors, or others hired by CONTRACTOR making deliveries of hazardous Materials (as defined in Title 49 CFR) to the site are in compliance with Title 49 CFR 172.800 – 172.804, which requires each person who offers for transportation in commerce or transports in commerce one or more of the following hazardous materials, as defined by Title 49 CFR, must develop and adhere to a security plan for hazardous materials that conforms to the requirements of this subpart.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

++ END OF SECTION ++
SECTION 01420

REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

A. General: Definitions of basic Contract terms are included in the General Conditions.

B. Definitions of terms commonly found in the Specifications are as follows:
   1. Indicated: The term indicated refers to graphic representations, notes, or schedules on the Drawings, or to other paragraphs or schedules in the Specifications and similar locations in the other Contract Documents. Terms such as “shown”, “noted”, “scheduled”, and “specified” are used to help the user locate the reference. There is no limitation on the location.
   2. Installer (or applicator, or erector): An installer is CONTRACTOR or another entity engaged by CONTRACTOR, either as an employee or subcontractor to perform a particular construction activity, including installation, erection, application or similar operations. Installers are required to be experienced in the operations they are engaged to perform.
      a. The term “experienced”, when used with the term “installer”, means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with the special requirements indicated; and having complied with the requirements of authorities having jurisdiction and of the Supplier of the product being installed.
   3. Trades: Use of a term such as “carpentry” does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as “carpenter”. It also does not imply that requirements specified apply exclusively to trades persons of the corresponding generic name.
   4. Assigned Specialists: Certain Sections of the Specifications require that specific construction activities shall be performed by specialists who are recognized experts in those operations. Said specialists shall be engaged for those activities, and their engagement is a requirement over which CONTRACTOR has no option. These requirements shall not be interpreted to conflict with the enforcement of building codes and similar regulations governing the Work. Also, they are not intended to interfere with local trade-union jurisdictional settlements and similar conventions. Such assignments shall not relieve CONTRACTOR of its responsibility for fulfilling the requirements of the Contract Documents.

91st Avenue WWTP Sludge Solar Drying Beds 01420-1 01/28/17
5. Equipment Identification: Several terms define the information attached to equipment.
   a. The term “CMMS Tag” means information attached to equipment pertaining to the City of Phoenix Water Services Department Computerized Maintenance Management System. CMMS Tags shall be provided by the CONTRACTOR. Refer to Section 01630, Equipment Identification Tag System for specifications regarding CMMS Tags.
   b. The term “Manufacturer Nameplate” means information attached to equipment by the manufacturer pertaining to equipment criteria, such as capacity, power supply requirement, model number, etc.

1.2 ABBREVIATIONS

   A. Common abbreviations, which may be found in the Specifications, are:

   alternating current  AC
   Ampere A
   ante meridiem am
   Average avg.
   biochemical oxygen demand BOD
   brake horsepower BHP
   British thermal unit BTU
   Centigrade C
   Company Co.
   cubic inch cu. in.
   cubic foot cu. ft.
   cubic yard cu. yd.
   cubic feet per minute cfm
   cubic feet per second cfs
   Decibel DB
   degree Centigrade (or Celsius) (Say) 20°C
   degree Fahrenheit (Say) 68°F
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<td>Diameter</td>
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liter
maximum
mercury
milligram
milligrams per liter
milliliter
millimeter
million gallons per day
million gallon
minimum
National Pipe Threads
net positive suction head
number
ounce
outside diameter
parts per million
post meridiem
pound
pounds per square inch
pounds per square inch absolute
pounds per square inch gage
pounds per square foot
revolutions per minute
second
specific gravity
square
square foot

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max.
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mg
mg/l
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mm
mgd
mil
min.
NPT
nps
No.
oz
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ppm
pm
lb
psi
psia
psig
psf
rpm
sec.
sp gr
sq
sq ft
1.3 APPLICABLE CODES

A. When a reference standard is specified, comply with requirements and recommendations stated in that standard, except when they are modified by the Contract Documents, or when applicable laws, ordinances, rules, regulations or codes establish stricter standards. The latest provisions of applicable standards shall apply to the Work, unless otherwise specified. Reference standards include, but are not necessarily limited to, the following:

1. American Association of State Highway and Transportation Officials (AASHTO).
2. American Concrete Institute (ACI).
3. American Gear Manufacturers Association (AGMA).
5. American Iron and Steel Institute (AISI).
7. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
8. American Society of Mechanical Engineers (ASME).
10. American Water Works Association (AWWA).
12. Concrete Reinforcing Steel Institute (CRSI).
13. Factory Mutual (FM).
14. Institute of Electrical and Electronics Engineers (IEEE).
15. National Electrical Manufacturer’s Association (NEMA).
18. Occupational Safety and Health Administration (OSHA).
20. Prestressed Concrete Institute (PCI).
22. All other applicable standards listed in the Specifications and the standards of utility service companies, where applicable.
23. Maricopa Association of Governments (MAG), Uniform Standard Specifications for Public Works Construction, as supplemented by the City of Phoenix. References to MAG Standard Details refer to the “Uniform Standard Details for Public Works Construction” sponsored and distributed by the Maricopa Association of Governments 1999, Arizona.


27. Uniform Building Code as supplemented by the City of Phoenix, Building Construction Code.


30. International Fuel and Gas Code, with City of Phoenix Amendments.

31. International Mechanical Code, with City of Phoenix Amendments.

32. Uniform Plumbing Code, with City of Phoenix Amendments.

33. National Sanitation Foundation (NSF-61) and Arizona Administration Code (AAC # 18-4-213)
   a. Incorporate the requirements NSF-61, Drinking Water System Components Health Effects and AAC # 18-4-213, Standards for Additives, Materials and Equipment on all potable water systems, water treatment facilities and water distribution facilities.

B. To ensure consistent application of standards and codes the following terminology definitions shall be applicable throughout the contract documents.

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<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<td>Phoenix Building Code</td>
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<tr>
<td>Phoenix Electrical Code</td>
<td>National Electric Code – NFPA 70 with City of Phoenix Amendments</td>
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<tr>
<td>Phoenix Fuel and Gas Code</td>
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<tr>
<td>Phoenix Mechanical Code</td>
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Phoenix Plumbing Code  Uniform Plumbing Code with City of Phoenix Amendments
Phoenix Construction Code  All of the Codes Listed Above

1.4 OWNER’S REFERENCE SPECIFICATIONS – NOT USED

1.5 INDUSTRY STANDARDS

A. Applicability of Standards: Except where the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: For applicable publication dates, refer to General Conditions.

C. Conflicting Requirements: Where compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, refer to ENGINEER for a decision before proceeding.

D. Copies of Standards: Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents. Where standards are required to perform a required construction activity, obtain copies of same from the publication source.

E. Abbreviations and Names: Whenever in these Specifications or the other Contract Documents references are made to the standards, specifications, or other published data of international, national, regional or local organizations, such organizations may be referred to by their acronym or abbreviation only. The following acronyms or abbreviations, which may appear in the Specifications, shall have the meanings indicated herein.

1. AA  Aluminium Association
2. AABC  Associated Air Balance Council
3. AAMA  American Architectural Manufacturers Association
4. AASHTO  American Association of State Highway and Transportation Officials
<table>
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<th></th>
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32. AWPI American Wood Preservers' Institute
33. AWS American Welding Society
34. AWWA American Water Works Associations
35. BHMA Builders Hardware Manufacturers’ Association
36. CBMA Certified Ballast Manufacturers’ Association
37. CDA Copper Development Association
38. CGA Compressed Gas Association
39. CISPI Cast Iron Soil Pipe Institute
40. CMAA Crane Manufacturers’ Association of America
41. CRSI Concrete Reinforcing Steel Institute
42. EPA Environmental Protection Agency
43. ETL Engineering Test Laboratories
44. FCC Federal Communications Commission
45. FEMA Federal Emergency Management Agency
46. FGMA Flat Glass Marketing Association
47. FM Factory Mutual Association
48. FS Federal Specification
49. GA Gypsum Association
50. HEW Department of Health, Education and Welfare
51. HI Hydraulic Institute
52. HMI Hoist Manufacturers’ Institute
53. HUD Department of Housing and Urban Development
54. ICBO International Conference of Building Officials
55. ICEA Insulated Cable Engineers’ Association
56. IEEE Institute of Electrical and Electronic Engineers
57. IES Illuminating Engineering Society
58. IFI Industrial Fasteners Institute
59. IRI Industrial Risk Insurers

91st Avenue WWTP Sludge Solar Drying Beds

01/28/17
| 60. | ISA | The Instrumentation Systems and Automation Society |
| 61. | ISO | Insurance Services Office |
| 62. | MAG | Maricopa Association of Governments |
| 63. | MIA | Marble Institute of America |
| 64. | MS  | Military Specifications |
| 65. | MMA | Monorail Manufacturers’ Association |
| 66. | NAAMM | National Association of Architectural Metal Manufacturers |
| 67. | NACE | National Association of Corrosion Engineers |
| 68. | NARUC | National Association of Railroad and Utilities Commissioners |
| 69. | NBHA | National Builders Hardware Association |
| 70. | NEC | National Electrical Code |
| 71. | NEMA | National Electrical Manufacturers Association |
| 72. | NESC | National Electrical Safety Code |
| 73. | NFPA | National Fire Protection Association |
| 74. | NHLA | National Hardwood Lumber Association |
| 75. | NHPMA | Northern Hardwood and Pine Manufacturer’s Association |
| 76. | NLMA | National Lumber Manufacturers’ Association |
| 77. | NRCA | National Roofing Contractors Association |
| 78. | NSF | National Sanitation Foundation |
| 79. | NTMA | National Terrazzo and Mosaic Association |
| 80. | NWWDA | National Wood Window and Door Association |
| 81. | OECl | Overhead Electrical Crane Institute |
| 82. | OSHA | Occupational Safety and Health Administration |
| 83. | PCI  | Precast Concrete Institute |
| 84. | PEI  | Porcelain Enamel Institute |
| 85. | PPI  | Plastic Pipe Institute |
| 86. | PS   | Product Standards Section-U.S. Department of Commerce |
87. RMA Rubber Manufacturers’ Association
88. SAE Society of Automotive Engineers
89. SCPRF Structural Clay Products Research Foundation
90. SDI Steel Deck Institute
91. SDI Steel Door Institute
92. SIGMA Sealed Insulating Glass Manufacturing Association
93. SJI Steel Joist Institute
94. SMACNA Sheet Metal and Air Conditioning National Association
95. SPI Society of the Plastics Industry
96. SSPC The Society for Protective Coatings
97. SWI Steel Window Institute
98. TEMA Tubular Exchanger Manufacturers’ Association
99. TCA Tile Council of America
100. UL Underwriters’ Laboratories, Inc.
101. USGS United States Geological Survey
102. USPHS United States Public Health Service
103. WCLIB West Coast Lumber Inspection Bureau
104. WWEMA Water and Wastewater Equipment Manufacturers Association
105. WWPA Western Wood Products Association

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++
SECTION 01452

TESTING LABORATORY SERVICES FURNISHED BY CONTRACTOR

PART 1 - GENERAL

1.1 DESCRIPTION

A. Employ and pay for an independent testing laboratory to perform the specified services. Laboratory selected shall be subject to approval by the ENGINEER.

1.2 QUALIFICATIONS OF LABORATORY

A. Where applicable, meet “Recommended Requirements for Independent Laboratory Qualification,” latest edition, published by American Council of Independent Laboratories and the basic requirements of ASTM E 329, “Standards of Recommended Practice for Inspection and Testing Agencies for Concrete and Steel as Used in Construction.” Laboratory shall be authorized to operate in the State of Arizona.

B. Submit five copies of report of inspection of facilities made by Materials Reference Laboratory of National Bureau of Standards, for the most recent tour of inspection, with memorandum of remedies of any deficiencies reported by inspection.

C. Testing Equipment:
   1. Calibrated, at maximum 12-month intervals by devices of accuracy traceable to either National Bureau of Standards or accepted values of natural physical constants.
   2. Submit copy of certificate of calibration made by an accredited calibration agency.

1.3 LABORATORY DUTIES

A. Cooperate with ENGINEER and provide qualified personnel promptly on notice.

B. Perform specified inspections, sampling and testing of materials and methods of construction; comply with applicable standards; and ascertain compliance with requirements of Contract Documents.

C. Promptly notify ENGINEER and CONTRACTOR of any irregularities or deficiencies of Work that are observed during performance of services.
D. Promptly submit five copies of reports of inspections and tests to ENGINEER, including:
   1. Date issued.
   2. Project title and number.
   3. Testing laboratory name and address.
   4. Name and signature of inspector.
   5. Date of inspection or sampling.
   6. Record of temperature and weather.
   7. Date of test.
   8. Identification of product and Specification Section.
   9. Location in Work.
   10. Type of inspection or test.
   11. Results of tests and observations regarding compliance with Contract Documents.

E. Perform additional tests and services as required to ensure compliance with the Contract Documents.

1.4 CONTRACTOR’S COORDINATION WITH LABORATORY

A. Cooperate with laboratory personnel, and provide access to Work and to manufacturer’s operations.

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

C. Furnish labor and facilities:
   1. To provide access to Work to be tested.
   2. To obtain and handle samples at the site.
   3. To facilitate inspections and tests.
   4. For laboratory’s exclusive use for storage and curing of test samples.
   5. Forms for preparing concrete test beams and cylinders.

D. Notify laboratory and ENGINEER sufficiently in advance of operations to allow for assignment of personnel and scheduling of tests.

E. Arrange with laboratory and pay for, additional samples and tests required for CONTRACTOR’S convenience.

1.5 PRODUCT TEST REPORTS

A. Furnish copies of product test reports where required by the Specifications or requested by ENGINEER.
PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++
SECTION 01550

ACCESS ROADS AND PARKING AREAS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide all temporary construction roads, walks and parking areas required during the construction and for use of emergency vehicles. Temporary roads and parking areas shall be designed and maintained by CONTRACTOR so as to be fully usable in all weather conditions.

B. Prevent interference with traffic and the OWNER’S operations on existing roads. Indemnify and save harmless the OWNER from any expenses caused by CONTRACTOR’S operations over these roads.

C. Roadway damage shall be restored to the original condition by CONTRACTOR subject to approval of the OWNER or ENGINEER.

D. Temporary roads, walks and parking areas shall be removed by CONTRACTOR, prior to Final Acceptance, and the ground returned to its original condition, unless otherwise required by the Contract Documents.

1.2 DESIGNATED PARKING

A. All CONTRACTOR’S employee vehicles shall park in an area specifically designated for that purpose, as more fully described in Section 01561, Security.

1.3 MAINTENANCE OF ROADS

A. At all times maintain approved access for trucks to loading areas of the plant and parking facilities for plant personnel. All parking of construction vehicles shall be in approved lots.

B. Have all paved roads swept by mechanical sweeper, a minimum once a day or as directed by the ENGINEER. Keep roads serviceable at all times. Specific roads include:
   1. All roads within the limits of this Contract.
   2. Plant roads from entrance to work parking and work sites.
C. Dust resulting from construction shall be controlled by CONTRACTOR to prevent a nuisance on the site or in adjacent areas. Apply water or use other methods subject to the ENGINEER’S approval, which will keep dust in the air to a minimum. Use of water will not be permitted when it results in hazardous or objectionable conditions such as ice, mud, ponds and pollution.

D. Provide temporary heavy duty steel roadway plates to protect existing manholes, handholes, valve boxes and vaults.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++
SECTION 01551

MAINTENANCE AND PROTECTION OF TRAFFIC

PART 1 - GENERAL

1.1 DESCRIPTION

A. All streets and trafficways shall be kept open for the passage of traffic and pedestrians during the construction period, unless otherwise approved by the ENGINEER, in writing, or authority having jurisdiction over same. Construction traffic at the City of Phoenix 91st Ave. WWTP site shall only use the entrances stated in Section 01561, Security.

B. When required to cross, obstruct or temporarily close a street or trafficway, provide and maintain suitable bridges, detours or other approved temporary expedient for the accommodation of traffic. Closings shall be for the shortest time practical, and passage shall be restored immediately after completion of backfill and temporary paving or bridging.

C. Give the required advance notice to the fire and police departments of proposed operations.

D. Give reasonable notice to owners or tenants of private property who may be affected by CONTRACTOR’S operations. A minimum 20 day notice shall be given.

E. Provide signs, signals, barricades, flares, lights and all other equipment, service and personnel required to regulate and protect all traffic and warn of hazards. All such work shall conform to requirements of the OWNER or authority having jurisdiction. Remove temporary equipment and facilities when no longer required, and restore grounds to original or to specified conditions.

1.2 TRAFFIC SIGNALS AND SIGNS

A. Provide and operate traffic control and directional signals required to direct and maintain an orderly flow of traffic in all areas under CONTRACTOR’S control, or affected by CONTRACTOR’S operations.

1.3 PARKING CONTROL

A. Control all CONTRACTOR related vehicular parking within the limits of the Work to preclude interference with OWNER'S operations, or construction operations.
B. Monitor parking of all construction and private vehicles:
   1. Maintain free vehicular access to and through parking areas.
   2. Prohibit parking on or adjacent to access roads or in non-designated areas.
   3. All construction vehicles must possess current registration.
   4. Private vehicles shall park only in the designated areas.

1.4 HAUL ROUTES

A. Consult with governing authorities and establish thoroughfares which will be used as haul routes and site access.

B. Submit requested routes to ENGINEER and OWNER for designation as haul route and secure approval of authorities.

C. Confine construction traffic to designated haul routes.

D. Provide traffic control at critical areas of haul routes to expedite traffic flow, and to minimize interference with normal public traffic.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION +
SECTION 01561

SECURITY

PART 1 - GENERAL

1.1 DESCRIPTION

A. Safely guard all Work, materials, equipment and property from loss, theft, damage and vandalism. CONTRACTOR’S duty to safely guard property shall include the OWNER’S property and other private property from injury or loss in connection with the performance of the Work.

B. Make no claim against the OWNER for damage or injury resulting from trespass.

C. Responsible for security and shall make good all damage to property of OWNER and others arising from failure to provide adequate security. The standard for security shall be, at a minimum, equivalent to the owner’s standards.

D. If the existing fencing or barriers are breached or removed for purposes of construction, provide and maintain temporary security fencing equal to the existing in a manner satisfactory to the ENGINEER and OWNER. Provide additional security staff, if required, to maintain the security of the facility.

E. Security measures taken shall be at least equal to those usually provided by OWNER to protect his existing facilities during normal operation.

F. Maintain security program throughout the Work until OWNER’S acceptance and occupancy precludes need for CONTRACTOR’S security program.

G. Comply with all aspects of OWNER’S site specific Security Guard Protocol. This shall include background checks equivalent to those conducted by the owner.

H. All costs for security as specified in this Section shall be borne by CONTRACTOR.

1.2 CONTRACTOR’S ACCESS TO THE SITE

A. Access to the construction site for CONTRACTOR’S employees, material, tools and equipment shall be from the designated construction entrance, or the COP 91st Ave. WWTP plant entrance only.
B. Ensure that each of his employees, representatives, delivery persons, suppliers and others acting for CONTRACTOR, shall be subject to the following regulations:

1. CONTRACTOR’S subcontractor’s, suppliers and manufacturer’s employee’s shall not park anywhere other than CONTRACTOR Employee’s Parking Area. The Area shall be designated by the ENGINEER. Prepare and maintain this area, as required.

2. All CONTRACTOR employees shall wear a laminated photograph identification and badge bearing CONTRACTOR’S name, employee’s name, and employee number at all times when the employee is on the site. Badge and Background Check Data form shall be completed by CONTRACTOR and approved by OWNER prior to CONTRACTOR personnel entering the site.

3. Turn over the identification badge to the OWNER upon the individual’s completion of the participation on the project or project completion.

4. OWNER reserves all rights to the approval of all CONTRACTOR, subcontractor, suppliers and manufacturers employees receiving an identification badge.

5. All vehicles, including those belonging to CONTRACTOR, his employees and subcontractors, delivery persons and suppliers entering the plant site shall conform to all security and safety regulations in force at the site. All vehicles entering and leaving the facility are subject to search.

6. Personal vehicles shall not be allowed outside CONTRACTOR’S Employee Parking Area.

7. Delivery vehicles shall access the site from the designated construction entrance road stated in Paragraph 1.2 A. above.

8. Access to the construction site from any other entrance is strictly prohibited, unless prior approval is obtained from the owner. Violators shall be banned from the site.

9. Firearms are not allowed on City property.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++
SECTION 01570

TEMPORARY CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide and maintain methods, equipment, and temporary construction, as necessary to provide controls over environmental conditions at the construction site and adjacent areas. Remove physical evidence of temporary facilities at completion of Work.

B. Obtain all City, County and State permits required for the construction of all Work, including Hazardous Material Management, Earth Moving/ Dust Control and Stormwater/Stormwater Pollution Prevention Permits.

1.2 NOISE CONTROL

A. CONTRACTOR’S vehicles and equipment shall be such as to minimize noise to the greatest degree practicable. Noise levels shall conform to the latest OSHA standards and in no case will noise levels be permitted which interfere with the Work of the OWNER or others.

1.3 WATER CONTROL

A. Provide methods to control surface water and water from excavations and structures to prevent damage to the Work, the site, or adjoining properties.
   1. Control fill, grading and ditching to direct water away from excavations, pits, tunnels and other construction areas and to direct drainage to proper runoff courses so as to prevent any erosion, damage or nuisance.

1.4 EROSION CONTROL

A. Plan and execute construction and earth work by methods to control surface drainage from cuts and fills, and from borrow and waste disposal areas, to prevent erosion and sedimentation.
   1. Hold the areas of bare soil exposed at one time to a minimum.
   2. Provide temporary control measures such as berms, dikes and drains.

B. Construct fills and waste areas by selective placement to eliminate surface silts or clays which will erode.
C. Periodically inspect earthwork to detect any evidence of the start of erosion; apply corrective measures as required to control erosion.

D. Coordinate erosion control requirements with the requirements of Article 1.4, above.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++
SECTION 01600

GENERAL EQUIPMENT PROVISIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. These General Equipment Provisions apply to all equipment furnished under this Contract including equipment specified in Division 11, Equipment, Division 13, Special Construction, Division 14, Conveying Systems, Division 15, Mechanical, Division 16, Electrical, and Division 17, Instrumentation. These General Provisions shall supplement the Detailed Equipment Specifications, but in case of conflict the Detailed Equipment Specifications shall govern.

B. Environmental Conditions:
   1. All equipment and appurtenances specified in the scope of this Section shall be designed and configured for installation and operation in a corrosive environment.
   2. Equipment shown or specified for exterior locations shall be designed for continuous operation in a dusty environment, with normal ambient air temperatures of 120°F, and exposed to air that contains corrosive compounds.

1.2 QUALITY ASSURANCE

A. Arrangement:
   1. The arrangement of equipment shown on the Drawings is based upon information available to the ENGINEER at the time of design and is not intended to show exact dimensions peculiar to a specific manufacturer. The Drawings are, in part, diagrammatic, and some features of the illustrated equipment installation may require coordination to meet actual equipment installation requirements. Structural supports, foundations, connected piping, valves, and electrical conduit specified may have to be coordinated to accommodate the equipment provided. No additional payment will be made for the coordination.

B. Unit Responsibility:
   1. Equipment systems made up of two or more components shall be manufactured and assembled as a unit by the responsible manufacturer. The responsible manufacturer shall select all components of the system to assure compatibility, ease of construction and efficient maintenance. The responsible manufacturer shall coordinate selection and design of all system components, such that all
equipment furnished under the specification for the equipment system, including equipment specified elsewhere, but referenced in the specification, is compatible and operates properly to achieve the performance requirements specified. Unless otherwise specified, the responsible manufacturer shall be the manufacturer of the driven equipment. Agents, representatives or other entities that are not a direct component of the manufacturing corporation will not be acceptable as a substitute for the manufacturer’s corporation in conforming to this requirement. This requirement for unit responsibility shall in no way relieve CONTRACTOR of his responsibility to the OWNER for performance of all systems.

2. Assure that all equipment systems provided for the Project are products for which unit responsibility has been accepted by the responsible manufacturer. Where the detailed specification requires a certificate from the Unit Responsibility Manufacturer, coordinate delivery of such certificates. Certificates shall conform to the content, form and style of Form 01600-B specified in Section 01331, Reference Forms, shall be signed by an officer of the manufacturer’s corporation and shall be notarized. No other submittal material will be processed until a Certificate of Unit Responsibility has been received and has been found to be satisfactory. Failure to provide acceptable proof that the unit responsibility requirement has been satisfied will result in withholding approval of progress payments for the subject equipment even though the equipment may have been installed in the Work.

1.3 WORKMANSHIP AND MATERIALS

A. All equipment shall be designed, fabricated and assembled in accordance with the best modern engineering and shop practice and in accordance with applicable standards. Individual parts shall be manufactured to standard sizes and gauges so that repair parts, furnished at any time, can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall not have been in service at any time prior to delivery, except as required for tests.

B. In various Sections of the Specification, manufacturer’s names have been used for clarity and to establish minimum product standards only. Responsibility for selection and coordination of all materials required for construction belongs to CONTRACTOR.

C. All parts and components of mechanical equipment shall be designed for satisfactory service under continuous duty and under the specified and indicated operating conditions. Any part of mechanical equipment that shows excessive wear or fails due to wear, under normal operating conditions, within the warranty period shall be considered as evidence of defective material or defective workmanship, and it shall be replaced by CONTRACTOR with equipment or parts to meet the specified requirements, at no additional cost to the OWNER.
D. Bronze which shall be in contact with water or any liquid, used in the manufacture of any equipment shall not contain aluminum or more than six percent zinc, and shall conform to ASTM B62, or equivalent.

E. Tolerances and clearances, shall be as indicated on the Shop Drawings, and these tolerances and clearances shall be closely followed to secure proper operation of the equipment.

F. All flanges on equipment and equipment appurtenances furnished shall conform in dimensions and drilling to ANSI B16.1, Class 150, unless otherwise noted.

G. Responsibility to coordinate compatible materials of construction for all elastomer components for all seats, seals, gaskets, etc., for each process application belongs to CONTRACTOR. Acceptable compatible materials of construction for all elastomer materials are as follows:

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<tr>
<th>Process Fluid</th>
<th>Compatible Materials of Construction</th>
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<tbody>
<tr>
<td>Ferric Chloride</td>
<td>Buna, EPDM, Teflon, Viton</td>
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<tr>
<td>Hydrochloric Acid</td>
<td>Teflon, Viton</td>
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<tr>
<td>Sodium Hydroxide</td>
<td>Teflon, Hypalon, Polypropylene, EPDM</td>
</tr>
<tr>
<td>Sodium Hypochlorite</td>
<td>Teflon, PVDF, Hypalon, Polypropylene</td>
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<tr>
<td>Polymer</td>
<td>Viton, Teflon</td>
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<tr>
<td>Methanol</td>
<td>Buna-N, Teflon</td>
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### 1.4 MANUFACTURER’S NAMES

A. Manufacturer’s name and catalog numbers are for the convenience of CONTRACTOR. The detailed Contract Documents shall apply in the event of a conflict. If detailed Contract Documents have not been given, the manufacturer’s name and catalog number shall determine the design criteria for comparison should an equal be submitted.

### 1.5 REGULATIONS AND CODES

A. Electrical and Instrumentation Work, furnished with equipment supplied under Division 11, Equipment, Division 13, Special Construction, Division 14, Conveying Systems, and Division 15, Mechanical, including connection to electrical equipment integral with mechanical equipment, shall be performed in accordance with the requirements of Division 16, Electrical, and Division 17, Instrumentation. When applicable, the material used in the performance of the electrical Work shall be approved by the Underwriter’s Laboratories, Inc. (UL) for the class of service for which they are intended.
1.6 BEARINGS

A. Unless otherwise specified, all equipment bearings shall be oil or grease lubricated and ball or roller antifriction type of standard manufacture. Bearings shall be conservatively designed to withstand all stresses of the service specified. Each bearing, except as otherwise noted, shall be rated in accordance with the latest revisions of Anti-Friction Bearing Manufacturer’s Association’s (AFBMA) Methods of Evaluating Load Ratings of Ball and Roller Bearings for B-10 rating life of 100,000 hours.

B. All grease lubricated bearings, except those specified to be factory sealed lubricated, shall be fitted with easily accessible grease supply, flush, drain, and relief fittings of the standard hydraulic type. Extension tubes shall be provided for easy access.

C. Oil-lubricated bearings shall be equipped with either a pressure lubricating system or a separate oil reservoir type system. Each oil lubrication system shall be of sufficient size to safely absorb the heat energy normally generated in the bearing under a maximum ambient temperature of 55°C and shall be equipped with a filler pipe and an external level gauge. Fittings for pressure lubrication shall be 1/4-inch straight type.

D. To avoid work hardening or “Brinelling” damage from vibration, bearings shall be separately packed or otherwise suitably protected during transport.

1.7 LUBRICATION AND LUBRICATION FITTINGS

A. Equipment shall be adequately lubricated by systems that require attention no more often than weekly during continuous operation. Lubrication systems shall not require attention during startup or shutdown and shall not waste lubricants. Lubricants of the type recommended by the equipment manufacturer shall be provided in sufficient quantity for consumption prior to completion of required testing and commissioning of equipment. Provide the ENGINEER at Substantial Completion of the Project or portion of the Project, 3 copies of a list showing the proper lubricants for each item of mechanical equipment, approximate quantities needed per year of continuous operation, and recommended lubrication intervals. Wherever possible, the types of lubricants shall be consolidated with the manufacturer’s approval to minimize the number of different lubricants required for plant maintenance.

B. Equipment and bearing lubrication fittings shall be extended with piping beyond obstructions, such as guards or covers, to provide ease of lubrication without disassembly of the unit.
C. All lubrication fittings shall be constructed of Type 304L stainless steel and shall be brought to the outside of all equipment so they are readily accessible from the outside without the necessity of removing covers, plates, housing, or guards. Fittings shall be of button head type. Lubrication fittings shall be mounted together wherever possible and shall be made of factory-mounted multiple fitting assemblies. Fittings shall not be individual fittings field-mounted together.

D. Lubrication: Food grade oil meeting NSF 61 for water applications or oil bath for wastewater applications.

1.8 EQUIPMENT BASES AND BEDPLATES

A. A heavy cast iron, FRP, or stainless steel base shall be provided for each item of equipment that is to be installed on a concrete base, in accordance with the equipment manufacturer’s requirements. Equipment assemblies, unless otherwise specified or shown on the Drawings, shall be mounted on a single, heavy, cast iron, FRP, or stainless steel bedplate, in accordance with the equipment manufacturer’s requirements. Bases and bedplates shall be provided with machined support pads, tapered dowels for alignment of mating or adjacent items, adequate openings to facilitate grouting, and openings for electrical conduits. Seams and contact edges between stainless steel plates and shapes shall be continuously welded and ground smooth. Bedplate drain fittings shall be piped to the nearest sump or designated drainage area.

B. After assembly and installation on the concrete base, each unit shall be leveled, using a precision level, and aligned in place but not grouted until after the initial fitting and alignment of connecting piping. Each unit shall then be grouted to the concrete base. Each base and bedplate shall be completely filled with grout, where applicable. The grout shall extend to the edge of each base or bedplate and shall be beveled at 45 degrees all around the unit. Grout exposed at horizontal surfaces shall be rounded to provide drainage to appropriate points. After grout has set, jacking screws shall be removed, and nuts on anchor bolts shall be tightened followed by an overall check on leveling and alignment. Should equipment not meet tolerances of leveling and alignment, as recommended by the manufacturer, corrective measures shall be taken to obtain the tolerances required. Reciprocating equipment shall be grouted with non-shrinking epoxy grout, as specified under Section 03600, Grout.

1.9 EQUIPMENT GUARDS

A. Belt or chain drives, fan blades, couplings, exposed shafts, and other moving or rotating parts shall be covered on all sides by guards conforming with the General Industry Safety Orders of the Arizona Division of Industrial Safety. The guards shall be fabricated from 15 USS gauge or heavier aluminum or Type 316 stainless steel. Each guard shall be designed for easy installation and removal. Necessary supports and accessories shall be provided for each guard. Guards in outdoor
locations shall be designed to prevent the entrance of rain and dripping water. Drawings of the guards shall be submitted to the ENGINEER for approval prior to fabrication or delivery.

B. Secure guards in position by aluminum or Type 316 stainless steel braces or straps, securely fastened to floor, wall, or frame of the equipment. Fastenings shall permit easy removal for servicing the equipment.

1.10 EQUIPMENT DATA NAMEPLATES

A. Manufacturers nameplates shall meet requirements as stated in individual equipment specifications. Manufacturers equipment data nameplates shall be stamped on Type 316 stainless steel and fastened to the equipment in an accessible location with No. 4 or larger oval head Type 316 stainless steel screws or drive pins. The nameplate shall include manufacturer’s name, equipment model number, serial number, drive speed, motor horsepower, and rated capacity etc. Manufacturers nameplates for pumps shall also include, at a minimum, rated total dynamic head, impeller size and capacity, where applicable.

B. All storage tanks (steel, fiberglass and polyethylene), shall include a second sign with the description of the contents. The lettering on the sign shall be visible from at least ten feet.

C. Refer to Section 01630 for CMMS Tag requirements.

1.11 WARNING SIGNS

A. Furnish and install permanent warning signs at all mechanical equipment, prior to startup, that may be started automatically or from remote locations. Signs shall be located near the equipment, in accordance with safety regulations, and shall be suitable for exterior use.

B. Warning signs shall be colored yellow with black letters, on not less than 18 gauge vitreous enameling stock. Copy shall read:

   **CAUTION:**
   
   THIS EQUIPMENT STARTS AUTOMATICALLY

C. Each sign shall be clearly readable from a distance of 20 feet.

D. Additional warning sign requirements are specified in Section 10400, Identification Devices, if applicable.
1.12 EQUIPMENT PAINTING/COATINGS

A. Surfaces requiring painting or coating for corrosion protection shall be smooth, free from sharp edges, burrs, and projections and shall have all welds ground smooth and all edges and corners of structural members rounded. Non-conformance shall be grounds for rejection of equipment, as determined by the ENGINEER.

B. Equipment shall be shop-primed prior to delivery to the Work site, unless otherwise specified, in accordance with Section 09900, Painting.

C. Surfaces of equipment, which will be inaccessible after assembly, shall be painted or otherwise protected before assembly by a method that provides protection for the life of the equipment. Furnish equipment to replace any equipment that the ENGINEER determines to be damaged beyond repair by rust or mishandling, etc., while in storage or during installation by CONTRACTOR.

D. Manufacturers equipment or motor data nameplates shall not be painted.

E. The equipment supplier shall certify, by a letter included with the equipment submittal, confirming that the proposed primer and finish coating used is compatible with the approved Division 9, Finishes, painting scheme. After delivery to the Work site, the equipment finished surfaces shall be inspected and evaluated. A final coat of paint shall be applied to all equipment in the field.

F. Machined, polished, and other ferrous and non-ferrous surfaces that are not to be painted shall be coated with rust preventative compound, Dearborn Chemical “NO-Ox-Id”, Houghton “Rust Veto 344,” Rust-oleum “R9,” or approved equal. Should rust occur during shipment or storage, responsibility for correction, as determined by the ENGINEER, belongs to CONTRACTOR.

G. Copper, bronze, chromium plate, nickel, stainless steel, aluminum, monel metal, lead, lead coated copper, brass, and plastic are not to be painted or finished, unless otherwise specified or recommended by the manufacturer.

H. All metallic surfaces requiring a shop applied primer shall be primed with an approved priming system that has been certified, by letter, as being compatible with the Division 9, Finishes, coating systems proposed and shall be applied in accordance with the recommendations of the paint manufacturer. Submittal for equipment shall include:
   1. Coating manufacturer’s “Cut-sheet” describing components, surface preparation requirements, recommended mil thicknesses, and application procedures for the proposed primer.
   2. A letter from the equipment supplier stating that he has confirmed that the proposed primers are compatible and that the primer will be applied in accordance with the coating manufacturer’s requirements. In addition, the
letter shall certify that the appropriate surface preparations will be made prior
to primer application.

I. After delivery to the Work site, equipment surfaces shall be inspected and evaluated
by the ENGINEER. Touch-up or complete removal of shop priming, by
sandblasting or other approved method, may be required as determined by the
ENGINEER based on the condition of the equipment primer prior to final, in place,
finish coat application.

J. Field touch-up, final surface preparation, and final finish coatings shall be applied by
CONTRACTOR.

1.13 FACTORY TEST AND CERTIFICATION

A. All equipment, devices, and systems requiring factory test and certification, as
specified in these Specifications, may be witnessed by the OWNER. Notify the
ENGINEER, in writing, at least 30 calendar days in advance of all equipment,
devices and system testing. The written notifications shall specify the exact date and
location of the tests that will be conducted and shall define the test procedures to be
utilized. Testing procedure shall be scheduled and performed during normal
working hours and shall be subject to review by the ENGINEER.

1.14 VARIABLE FREQUENCY DRIVES

A. Variable frequency drives, motors, and pumps furnished by OWNER shall be
installed by CONTRACTOR and tested in accordance with Paragraph 1.14.C.,
below.

B. Unit Responsibility:
1. Have unit responsibility for proper coordination and compatibility of all
Variable Frequency Drives (VFDs) and controls furnished under Division 16,
Electrical, with the Division 11, Equipment, equipment and motors specified in
the Contract Documents, and shall have total responsibility for the satisfactory
installation and operation of the entire driven system, including driven
equipment, motors, drives, and controls as specified in the Contract
Documents.
2. The Division 11, Equipment, manufacturer shall assume sole unit responsibility
for the equipment and motors, and shall assume responsibility that the motors
supplied with the equipment will successfully operate the equipment over the
specified operating speed range. The equipment package, including motors,
shall operate successfully over the speed range and all other operating
characteristics provided by VFDs.
3. The motor manufacturer shall submit written approval, in letter form, of the VFD to be furnished as part of the submittal package. The equipment manufacturer shall perform field testing necessary to confirm compatibility of the drives with successful operation of the equipment throughout the complete operating range specified.

4. The Division 11, Equipment, manufacturer shall review the location of and relationship of the VFD with respect to the driven equipment and motor, and certify, in writing, the relationship will satisfactorily operate the unit(s) for its intended normal operating lifetime.

C. Testing:

1. Field Acceptance Testing: After installation of the system at the Work site and checkout by the drive manufacturer, a field acceptance test shall be conducted jointly by the drive manufacturer and the manufacturer of the driven equipment.
   a. The field acceptance test shall consist of repeating the factory acceptance testing procedure and an additional 24 hours of similar testing, during which the system shall run continuously without loss of basic functions. Functional tests shall demonstrate satisfactory operation of all interlocks, alarms, and normal operating sequences. The drive manufacturer shall use suitable test equipment to identify and correct malfunctions. Failure of redundant equipment will not be considered as downtime, provided that automatic failover occurs as specified herein and, that in the opinion of the ENGINEER, the failure was not caused by deficiency in design or installation. Repeated failure of any component shall be cause for the acceptance test to be terminated and restarted.

2. Verify that harmonics comply with the requirements of IEEE-519 at the motor control center.

1.15 EQUIPMENT INFORMATION FORMS

A. Complete Form 01600-A found in Section 01331, Reference Forms, for all equipment and devices that are specified in the Contract Documents. This includes each component mounted as a package, or “skid” mounted equipment and control panels. The completed Equipment Information Forms shall be included in the individual Operation and Maintenance Manuals.
CITY OF PHOENIX: Water Services Department
PROJECT NAME: 91st Avenue WWTP Sludge Solar Drying Beds
PROJECT NUMBER: WS90100098

++ END OF SECTION ++
SECTION 01620

INSTALLATION OF EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section describes Work necessary to install equipment and materials to be incorporated into this Project. It supplements the Specification requirements in Division 2, Sitework, through Division 17, Instrumentation.

B. Shop Drawings, installation drawings and instructions furnished by the manufacturers shall be used by CONTRACTOR in the installation of the equipment and materials.

1.2 ANCHOR BOLTS AND GROUT

A. Anchors and adhesive anchors shall be furnished by CONTRACTOR, as specified and required. Use adhesive anchors only where shown or approved by ENGINEER or required by the manufacturer. Anchors and adhesive anchors shall be of specified materials with heavy hexhead nuts. Anchorage items shall conform to the applicable requirements of Section 05051, Anchor Bolts, Expansion Anchors, Toggle Bolts and Concrete Inserts.

B. Grouting shall be in accordance with Section 03600, Grout, and Section 01600, General Equipment Provisions.

1.3 TRANSPORTING, HANDLING AND INSTALLING EQUIPMENT AND MATERIALS

A. Conform to requirements of Section 01600, General Equipment Provisions, and Section 01651, Transportation and Handling of Equipment and Materials.

B. Employ competent mechanics experienced in the installation of the types of equipment and materials to be furnished, and shall ensure that all equipment and materials are installed in accordance with the recommendations of the manufacturers.

1.4 EQUIPMENT ERECTION

A. General: Conform to the following as a minimum:
1. Use only mechanics, machinists or millwrights skilled in the handling, setting, aligning, leveling and adjusting of the type of equipment and materials furnished.

2. Use only an oil bath heater to expand couplings, gears, etc. Do not force or drive them on equipment shafts, nor subject them to an open flame or torch.

3. Wedging shall not be permitted. Use the least number of flat shims possible in leveling equipment. Shims shall be clean and free of slags. Provide all shims, filling pieces, keys, packing, red or white lead grout, or other materials necessary to properly align, level and secure apparatus in place. When requested by ENGINEER, demonstrate that all elements so required are level and plumb. Grind as necessary to bring parts to proper bearing after erection.

4. Use proper tools in the assembly of equipment and materials to prevent deforming or marring the surface of shafts, nuts or other parts.

5. Tighten connections requiring gaskets evenly all around to ensure uniform stress over the entire gasket area.

6. Equipment and materials shall not be altered or repaired, and no burning or welding shall be permitted on any parts having machined surfaces, except by written permission of ENGINEER.

7. No rigging shall be done from any structure without the permission of ENGINEER. Responsibility for any damage to the structure resulting from this operation, belongs to CONTRACTOR.

8. Use tools, equipment and materials that shall not damage the structure or equipment.

9. Furnish and install plugs in lubrication holes to prevent entry of foreign material.

10. Electrical work, testing, lubricating and painting shall all comply with requirements of the applicable Section.

B. Setting and Erection:

1. All units shall be carefully set and aligned on their foundations, by qualified millwrights, after their sole plates have been shimmed to true alignment at the anchor bolts. Anchor bolts shall be set in place and the nuts tightened against the shims. Bedplates or wing feet of the equipment shall be further checked after securing to the foundations and, after confirmation of all alignments, the sole plates shall be finally grouted in place. Be responsible for the correct alignment of equipment with its associated piping. “Pipe springing” shall not be allowed.

2. Misaligned holes shall be reamed. “Driving” of bolts or keys shall not be permitted.

C. Jacking Screws and Anchor Bolts:

1. All equipment shall be anchored to supporting members by bolts or other connections to accommodate all operating forces and satisfy the seismic restraint requirements of the Phoenix Building Code for Zone 1 Seismic Area.
Anchors shall provide resistance to a lateral force of at least 0.30 times the weight of the equipment, including its contents.

2. Jacking screws shall be provided in the heavy equipment bases and bedplates, and where required elsewhere, to aid in leveling during installation.

3. Anchor bolt setting drawings shall be delivered sufficiently early to permit setting the anchor bolts when the structural steel support frame is fabricated by others.

4. All anchor bolts and anchoring hardware shall be of Type 316 stainless steel. Adhesive anchors shall only be used where permitted by the ENGINEER and shall be Type 316 stainless steel. Alternate methods of anchoring to those shown on the Contract Documents shall meet the requirements of this Section and shall be submitted to the ENGINEER for review.

D. Alignment and Leveling:
1. Field check all shafts, couplings and sheaves for alignment and adjust to manufacturer’s specifications where necessary.

2. Couplings shall be aligned while the equipment is free from all external loads.

3. Angular and parallel alignment shall be checked, and the actual alignment shall be recorded and submitted to ENGINEER. Alignment shall be within manufacturer’s recommended tolerance.

4. Dial indicators shall be used for the checking of angular and parallel alignment. During rotation of the half couplings in performance of this test, they shall be maintained in the same relative position, and the dial indicator readings shall be taken at the same place on the circumference of the coupling.

E. Threaded Connections:
1. Apply a molybdenum disulfide, anti-seize compound to all threads in mechanical connections such as bolts, studs, cap screws, tubing, etc., unless otherwise specified.

F. Equipment Drive Guards:
1. Unless shown or specified otherwise, provide all equipment driven by open shafts, belts, chains, pulleys, sheaves, or gears with all-metal guards conforming to the requirements of Section 01600, General Equipment Provisions.

1.5 EQUIPMENT INSTALLATION

A. Obtain installation instruction booklets or other recommendations from the equipment manufacturers as to procedures for, sequence of, and tolerances allowed in equipment installation. In particular, the manufacturer’s recommendations as to grout spaces required, type of grout to be used, and tolerances for level and alignment, both vertical and horizontal, shall be obtained and followed. One copy of this material shall be given to the ENGINEER prior to the installation of the equipment.
B. Whenever applicable, obtain the services of a manufacturer’s representative specifically trained in erection of his equipment to supervise the installation. Be responsible for the proper alignment of all installed driven equipment and drives in accordance with the tolerance recommendation of the manufacturers for both OWNER furnished and CONTRACTOR furnished equipment. Within 14 calendar days after installation, submit to the ENGINEER a letter from the manufacturer, on the manufacturer’s letterhead, stating all equipment and components are installed in accordance with the manufacturer’s requirements and installation instructions as described in these Specifications.

C. Skilled craftsmen experienced in installation of the equipment or similar equipment shall be used. Applicable specialized tools and equipment, such as precision machinist levels, dial indicators, and gauges shall be utilized as required in the installations. The Work shall be accomplished in a workmanlike manner to produce satisfactory equipment installation free of vibration or other defects.

D. Install all OWNER furnished equipment in accordance with the installation instructions, Shop Drawings and submittals provided by the equipment manufacturers and available at the OWNER’S offices for CONTRACTOR’S use.

E. Prior to installation of equipment, all sacking and concrete preparation shall be completed and the Work area shall be maintained in a broom-clean condition during the equipment installation.

F. No equipment and materials shall be altered or repaired, and no burning or welding shall be permitted on any parts having machined surfaces, except by written permission of the ENGINEER.

G. No rigging shall be done from any structure without the permission of the ENGINEER. Responsibility for any damage to the structure resulting from this operation, belongs to CONTRACTOR.

H. Only such equipment and materials as will not damage the structure or equipment and materials shall be used on the Work.

1.6 SPECIAL TOOLS

A. All special tools that are required to assemble, disassemble, repair, and maintain any item of equipment furnished under the terms of this Contract shall be furnished with the equipment. When special tools are provided, they shall be marked or labeled and a list of such tools shall be included with the maintenance and operation instructions for the equipment.
1.7 COORDINATION

A. Take all measurements for Work at the installation sites, verify all subcontractor’s and manufacturer’s drawings, shall be responsible for the proper installation within the available space of the apparatus specified and shown on the Drawings and shall inform the ENGINEER of any variations and shall submit all proposed changes for review before making any changes.

1.8 SERVICES OF MANUFACTURERS’ REPRESENTATIVE

A. Equipment furnished under Divisions 11, 13, 14, 15, 16 and 17 shall include the cost of competent, qualified representatives of manufacturers of all equipment to supervise the installation, adjustment and testing of the equipment and to instruct the OWNER’S operating personnel on operation and maintenance. The training time and additional requirements for furnishing services of manufacturers’ representatives are specified in the appropriate Sections. If no time is specified, the training time shall be at least one day. Supervision may be divided into two or more time periods as required by CONTRACTOR’S schedule or as directed by ENGINEER.

B. Upon completion of the equipment installation, submit “Equipment Information Form”, Form 01600-A located in Section 01331, Reference Forms. The completed form shall also be included in the individual Operation and Maintenance Manuals.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++
SECTION 01630

COMPUTERIZED MAINTENANCE MANAGEMENT SYSTEM TAGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
1. Provide all labor, materials, equipment and incidentals, as shown on the Drawings, specified and required to furnish and install the CMMS tag system.
2. The extent of the CMMS tag system is specified herein and shown on the Drawings.
3. The CMMS tag system includes, but is not necessarily limited to, the following:
   a. CMMS tags.
   b. Miscellaneous mechanical fasteners.

B. CMMS Tags:
1. Provide sufficient quantity of identification tags for each piece of equipment listed in article 3.3.A. below.
2. Provide a quantity of blank tags equal to 10% of the number of tags required above under article 1.1.B.1.

1.2 QUALITY ASSURANCE

A. Source Quality Control: All CMMS tags and fasteners shall be the product of a single manufacturer.

1.3 SUBMITTALS

A. Samples: Submit for approval samples for color, materials and accessories required for the CMMS tag system. ENGINEER’S review of samples will be for color, material and fastener only. Compliance with all other requirements is the exclusive responsibility of CONTRACTOR.

B. Shop Drawings: Submit for approval the following:
1. Fasteners and accessory items.
2. Samples of actual equipment identification tags for five devices.

C. CMMS Tag List: Submit for approval the following:
1. Submit the finalized list of all CMMS tags including any alterations to the list that occur during construction. The list shall be provided on a compact disc in Microsoft Excel format (latest version) and shall include columns as shown under 3.3.A, CMMS Tag Information.
PART 2 - PRODUCTS

2.1 COMPUTERIZED MAINTENANCE MANAGEMENT SYSTEM TAGS

A. Material of Construction:
   1. Material: Aluminum
   2. Thickness: 0.020 inches
   3. Coating: Black enamel
   4. Size: 2-inches wide by 2-inches high
   5. Shape: Square with rounded corners
   6. Holes: One (1) 3/16-inch hole centered on one end of the tag

B. Engraving:
   1. Text location: CMMS tags shall be engraved with text centered on the tag.
   2. Lettering: Engraved Arial font 1/8-inch high characters. Stamped CMMS tags shall not be acceptable.
   4. Text quantity: CMMS tags shall accommodate at minimum four (4) lines of engraved text with a minimum of twenty (20) characters per line.
   5. CMMS Tag information:
      a. Equipment Name: See Table 3.3.A., CMMS Tag Information
      b. Alphanumeric ID#: See Table 3.3.A., CMMS Tag Information
      c. Serial Key: See Table 3.3.A., CMMS Tag Information
      d. Service Description: See Table 3.3.A., CMMS Tag Information

C. Fastener:
   1. Fasteners: 48-mil, stainless steel wire
   2. Fastener Clamp: Zinc double ferrule wire clamp.
   3. Alternate fasteners shall be approved by ENGINEER.

D. Layout:
   1. Refer to article 3.3.B, below for an example of the CMMS tag layout.

E. Manufacturer and Model:
   1. Brady, Model 87637
   2. Seton
   3. Or equal

PART 3 - EXECUTION

3.1 INSPECTION

A. CONTRACTOR and his installer shall examine the substrates and conditions under which the CMMS tags are to be installed and notify ENGINEER, in writing, of conditions detrimental to the proper and timely completion of the Work. Do not
proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

A. Install CMMS tags and components at the locations shown on the Drawings or, if not shown, at the nearest control point of the corresponding equipment, i.e. the local control panel, near a manual actuator, at the electrical disconnect, etc. The CMMS tag shall not interfere with the normal operation of the equipment. Where the location of the CMMS tag is such that it is not easily visible or the association between the CMMS tag and the corresponding equipment is not obvious install tags as directed by the ENGINEER.

B. Repair or replace damaged units as directed by ENGINEER.

3.3 EQUIPMENT INFORMATION

A. CMMS Tag Information:

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Equipment Name</th>
<th>Alphanumeric ID</th>
<th>Serial Key</th>
<th>Service Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>11318</td>
<td>End Suction Submersible Pumps – Dry Pit Installation</td>
<td>Decant PS 2 Pump</td>
<td>PMP-XXX</td>
<td>YYY</td>
<td>DEC</td>
</tr>
<tr>
<td>15441</td>
<td>Sump Pumps</td>
<td>Decant PS 2 Sump Pumps</td>
<td>PMP-XXX</td>
<td>YYY</td>
<td>DRAIN</td>
</tr>
<tr>
<td>15832</td>
<td>Centrifugal Roof Exhaust Fans Aluminum</td>
<td>Decant PS 2 Exhaust Fan</td>
<td>FAN-XXX</td>
<td>YYY</td>
<td>AIR</td>
</tr>
</tbody>
</table>

B. Example CMMS Tag Layout:
SECTION 01651

TRANSPORTATION AND HANDLING OF MATERIALS AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Make all arrangements for transportation, delivery and handling of equipment and materials required for prosecution and completion of the Work.

B. Shipments of materials to CONTRACTOR or subcontractors shall be delivered to the site only during regular working hours and shall conform to the requirements of Section 01413, CONTRACTOR’S Hazardous Materials Management Program. Shipments shall be addressed and consigned to the proper party giving name of Project, street number and city. Shipments shall not be delivered to OWNER, except where otherwise directed.

C. If necessary to move stored materials and equipment during construction, move materials and equipment without any additional compensation.

1.2 PREPARATION FOR SHIPMENT

A. When practical, factory assemble products. Matchmark or tag separate parts and assemblies to facilitate field assembly. Cover machined and unpainted parts that may be damaged by the elements with a strippable protective coating.

B. Package products to facilitate handling and protect from damage during shipping, handling, and storage. Mark or label outside of each package or crate to indicate its purchase order number, bill of lading number, contents by name, OWNER’S contract name and number, CONTRACTOR, equipment number, and approximate weight. Include complete packing lists and bills of materials with each shipment.

C. Protect products from exposure to the elements and keep thoroughly dry and dust free at all times. Protect painted surfaces against impact, abrasion, discoloration, or other damage. Grease or oil all bearings and similar items.

D. Do not have products shipped until:
   1. Related Shop Drawings have been approved by ENGINEER.
   2. Related factory test results, required in the individual Specification Sections, have been reviewed and accepted by ENGINEER.
   3. Required storage facilities have been provided.
E. Items shall be supported, packaged and stored in such a way so as not to impose undue stress/forces to couplings, connections, supports, valves, equipment and instruments.

1.3 DELIVERY

A. Arrange, with the United States Postal Service, a special address for the Project. All deliveries shall be made to that address.

B. Arrange deliveries of products in accordance with construction schedules and in ample time to facilitate inspection prior to installation.

C. Coordinate deliveries to avoid conflict with Work and conditions on site and to accommodate the following:
   1. Work of other contractors, or OWNER.
   2. Limitations of storage space.
   3. Availability of equipment and personnel for handling products.
   4. OWNER’S use of premises.

D. Do not have products delivered to Project site until related Shop Drawings have been approved by the ENGINEER.

E. Do not have products delivered to Project site until required storage facilities have been provided.

F. Have products delivered to site in manufacturer’s original, unopened, labeled containers. Keep ENGINEER informed of delivery of all equipment to be incorporated in the Work.

G. Partial deliveries of component parts of equipment shall be clearly marked to identify the equipment, to permit easy accumulation of parts and to facilitate assembly.

H. Immediately on delivery, inspect shipment to assure:
   1. Product complies with requirements of Contract Documents and reviewed submittal.
   2. Quantities are correct.
   3. Containers and packages are intact, and labels are legible.
   4. Products are properly protected and undamaged.
   5. Verify that the accelerometer recordings were made during shipment.

I. Promptly remove damaged products from the Project site and expedite delivery of new undamaged products, and remedy incomplete or lost products to provide that specified, so as not to delay progress of the Work.
1.4 PRODUCT HANDLING

A. Provide equipment and personnel necessary to handle products, including those provided by OWNER, by methods to prevent soiling or damage to products or packaging.

B. Provide additional protection during handling as necessary to prevent scraping, marring or otherwise damaging products or surrounding surfaces.

C. Handle products by methods to prevent bending or overstressing.

D. Lift heavy components only at designated lifting points.

E. Materials and equipment shall at all times be handled in a safe manner and as recommended by manufacturer or supplier so that no damage will occur to them. Do not drop, roll or skid products off delivery vehicles. Hand carry or use suitable materials handling equipment.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++
SECTION 01661

STORAGE OF MATERIALS AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Store and protect materials in accordance with manufacturer’s recommendations and requirements of Specifications.

B. Make all arrangements and provisions necessary for the storage of materials and equipment. All excavated materials, construction equipment, and materials and equipment to be incorporated into 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 maintained 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 and compactly stored in locations that will cause a minimum of inconvenience to other contractors, public travel, adjoining owners, tenants and occupants. Arrange storage in a manner to provide easy access for inspection.

C. Areas available on the site for storage of materials and equipment shall be as shown on the drawings or approved by the ENGINEER.

D. Materials and equipment, which are to become the property of the OWNER, shall be stored to facilitate their inspection and ensure preservation of the quality and fitness of the Work, including proper protection against damage by freezing, moisture and summer temperatures with ambient temperatures as high as 120°F. They shall be placed in inside climate storage areas, unless otherwise acceptable to OWNER. When placing orders to suppliers for equipment and controls containing computer chips, electronics and solid-state devices, request and coordinate specific temperature limitations on equipment since cabinets and components stored in the summer can approach temperatures of 200°F.

E. Be fully responsible for loss or damage, including theft, to stored materials and equipment.

F. Do not open manufacturer’s containers until time of installation, unless recommended by the manufacturer or otherwise specified.

G. Do not store products in the structures being constructed, unless approved in writing by the ENGINEER.
H. Lawns, grass plots or other private property shall not be used for storage purposes without written permission of the OWNER or other person in possession or control of such premises.

1.2 PROTECTION

A. Equipment shall be boxed, crated or otherwise completely enclosed and protected during shipment, handling and storage. Each container or piece of equipment shall be clearly marked with CONTRACTOR’S name, project name and location. Equipment shall be stored on raised supports protected from exposure to the elements and shall be kept thoroughly dry at all times. Pumps, motors, drives, electrical equipment, instrumentation equipment (controls, devices, panels, etc.) and other equipment having anti-friction or sleeve bearings shall be stored in weathertight storage facilities, such as warehouses. Covering with visquine or similar material shall not be considered as a weathertight enclosure.

B. Painted surfaces shall be protected against impact, abrasion, discoloration and other damage. Painted equipment surfaces, which are damaged prior to acceptance, shall be repainted in entirety to the satisfaction of the ENGINEER.

C. Electrical equipment, controls, and instrumentation shall be protected against moisture, water damage, heat or dust. Space heaters provided in the equipment shall be connected and operating at all times until equipment is placed in operation.

D. Items shall be stored in such a way so as not to impose undue stress/forces to couplings, connections, supports, valves, equipment and instruments.

1.3 UNCOVERED STORAGE

A. The following types of materials may be stored outdoors without cover:
   1. Reinforcing steel.
   2. Structural steel.
   3. Piping, except PVC.
   4. Precast concrete items.
   5. Castings.
   6. Imported soil, excavated engineered fill, sand, aggregate, crushed rock

B. Store the above materials on wood blocking so there is no contact with the ground.

1.4 COVERED STORAGE

A. The following types of materials may be stored outdoors if covered with material impervious to water:
1. Handrailing.
2. PVC Piping.

B. Tie down covers with rope and slope to prevent accumulation of water on covers.
C. Store materials on wood blocking or skids.
D. Store loose granular materials, covered with materials impervious to water, in a well-drained area or solid surfaces to prevent mixing with foreign matter.

1.5 FULLY PROTECTED STORAGE

A. Store all products not named above in buildings or trailers which have a concrete or wooden floor, a roof, and fully closed walls on all sides.
B. Provide heated storage space for materials which could be damaged by freezing.
C. Provide air-conditioned storage space for materials that could be damaged by Arizona’s severe high temperatures.
D. Protect mechanical and electrical equipment from being contaminated by dust, dirt and moisture.
E. Maintain humidity at levels recommended by manufacturers for electrical and electronic equipment.

1.6 HAZARDOUS PRODUCTS

A. Prevent contamination of personnel, the storage area and the site. Comply with the requirements of the Specification Section 01413, CONTRACTOR’S Hazardous Materials Management Program, codes and manufacturer’s instructions.

1.7 MAINTENANCE OF STORAGE

A. Maintain periodic system of inspection of stored products on a scheduled basis to assure that:
   1. State of storage facilities is adequate to provide required conditions.
   2. Required environmental conditions are maintained on a continuing basis.
   3. Products exposed to elements are not adversely affected.

1.8 PANEL AND INSTRUMENTATION STORAGE

A. All panels, microprocessor-based equipment and all other devices subject to damage or useful life decrease, because of temperatures below 40°F or above 100°F, relative
humidity above 90 percent, or exposure to rain or exposure to blowing dust shall not be stored on site.

B. Storage shall be in an insured, climate-controlled warehouse within Maricopa County. The OWNER shall have the right to inspect the equipment during normal working hours. Placed inside each panel or device shall be a desiccant, volatile corrosion inhibitor blocks (VCI), a moisture indicator and maximum-minimum indicating thermometer. The panels and equipment shall be checked once per month. The desiccant, VCI and moisture indicator shall be replaced as often as required or every six months, whichever occurs first. A certified record of the daily maximum and minimum temperature and humidity in the warehouse shall be available for inspection by the OWNER. A certified record of the monthly inspection, noting maximum and minimum temperature for the month, condition of desiccant, VCI and moisture indicator, shall also be available for inspection by the OWNER.

C. All costs for the storage shall be at no additional cost to the OWNER. Any panel or device which has been damaged by any cause or for which the storage temperatures or humidity range has been exceeded shall be replaced at no additional cost to the OWNER and shall not be cause for a delay in Contract completion.

D. The panels and equipment shall not be shipped to the site until field conditions are ready for installation, including all slabs, walls, roofs, and environmental controls. The failure to have the site ready for installation shall not relieve CONTRACTOR from conforming to all of the Contract requirements.

1.9 RECORDS

A. Keep running account of products in storage to facilitate preparation of progress payments, if Agreement provides for payment for products delivered, but not installed in the Work.

B. A record shall be kept of the storage requirements and a continuous maintenance log for all stored equipment. A tag shall be applied to each piece of equipment showing all service dates and who did the service.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++
SECTION 01721

PROTECTION OF THE WORK AND PROPERTY

PART 1 - GENERAL

1.1 DESCRIPTION

A. Be responsible for taking all precautions, providing all programs, and taking all actions necessary to protect the Work and all public and private property and facilities from damage as specified in the General Conditions and herein.

B. In order to prevent damage, injury or loss, CONTRACTOR’S actions shall include, but not be limited to, the following:
   1. Store apparatus, materials, supplies, and equipment in an orderly, safe manner that will not unduly interfere with the progress of the Work or the work of any other contractor or utility service company.
   2. Provide suitable storage facilities for all materials which are subject to injury by exposure to weather, theft, breakage, or otherwise.
   3. Place upon the Work or any part thereof only such loads as are consistent with the safety of that portion of the Work.
   4. Clean up frequently all refuse, rubbish, scrap materials, and debris caused by his operations, to the end that at all times the site of the Work shall present a safe, orderly and workmanlike appearance.
   5. Provide barricades and guard rails around openings, for scaffolding, for temporary stairs and ramps, around excavations, elevated walkways and other hazardous areas.

C. Shall not, except after written consent from proper parties, enter or occupy privately-owned land with personnel, tools, materials or equipment, except on easements provided herein.

D. Assume full responsibility for the preservation of all public and private property or facility on or adjacent to the site. If any direct or indirect damage is done by or on account of any act, omission, neglect or misconduct in the execution of the Work by CONTRACTOR, it shall be restored by CONTRACTOR, at his expense, to a condition equal to that existing before the damage was done.

E. CONTRACTOR shall be responsible for any staking/roping needed to identify the contractual limits of construction activities.

1.2 BARRICADES AND WARNING SIGNALS
A. Where Work is performed on or adjacent to any roadway, right-of-way, or public place, provide barricades, fences, lights, warning signs, danger signals, watchmen, and shall take other precautionary measures for the protection of persons or property and of the Work. Barricades shall be painted to be visible at night. From sunset to sunrise, furnish and maintain at least one light at each barricade. Sufficient barricades shall be erected to keep vehicles from being driven on or into Work under construction. Furnish watchmen in sufficient numbers to protect the Work. CONTRACTOR’S responsibility for the maintenance of barricades, signs, lights, and for providing watchmen shall continue until the Project is accepted by OWNER.

1.3 TREE AND PLANT PROTECTION

A. Protect existing trees, shrubs and plants on or adjacent to the site that are shown or designated to remain in place against unnecessary cutting, breaking or skinning of trunk, branches, bark or roots.

B. Materials or equipment shall not be stored or parked within the drip line.

C. Temporary fences or barricades shall be installed to protect trees and plants in areas subject to traffic.

D. Fires shall not be permitted.

E. Within the limits of the Work, water trees and plants that are to remain, in order to maintain their health during construction operations.

F. Cover all exposed roots with burlap which shall be kept continuously wet. Cover all exposed roots with earth as soon as possible. Protect root systems from mechanical damage and damage by erosion, flooding, run-off or noxious materials in solution.

G. If branches or trunks are damaged, prune branches immediately and protect the cut or damaged areas with emulsified asphalt compounded specifically for horticultural use in a manner approved by the ENGINEER.

H. All damaged trees and plants that die or suffer permanent injury shall be removed and disposed of off-site when ordered by the ENGINEER and replaced by a specimen of equal or better quality.

I. Coordinate Work in this Section with requirements of Section 02220, Demolition, Section 02230, Clearing, and Section 02901, Landscaping.
1.4 PROTECTION OF EXISTING STRUCTURES

A. Underground Structures:
   1. Underground structures are defined to include, but are not limited to, all sewer, water, gas, and other piping, and manholes, chambers, electrical conduits, tunnels and other existing subsurface work located within or adjacent to the limits of the Work.
   2. All underground structures known to ENGINEER, except water, gas, sewer, electric, and telephone service connections, are shown. This information is shown for the assistance of CONTRACTOR, in accordance with the best information available, but is not guaranteed to be correct or complete.
   3. Explore ahead of trenching and excavation Work and shall uncover all obstructing underground structures sufficiently to determine their location, to prevent damage to them and to prevent interruption to the services which such structures provide. If CONTRACTOR damages an underground structure, he shall restore it to original condition at his expense.
   4. Necessary changes in the location of the Work may be made by ENGINEER to avoid unanticipated underground structures.
   5. If permanent relocation of an existing underground structure or other subsurface facility is required and is not otherwise provided for in the Contract Documents, ENGINEER will direct CONTRACTOR, in writing, to perform the Work, which shall be paid for under the provisions of the General Conditions.

B. Surface Structures:
   1. Surface structures are defined as all existing buildings, structures and other facilities above the ground surface. Included with such structures are their foundations or any extension below the surface. Surface structures include, but are not limited to, buildings, tanks, walls, bridges, roads, dams, channels, open drainage, piping, poles, wires, posts, signs, markers, curbs, walks and all other facilities that are visible above the ground surface.

C. Protection of Underground and Surface Structures:
   1. Sustain in their places and protect from direct or indirect injury all underground and surface structures located within or adjacent to the limits of the Work. Such sustaining and supporting shall be done carefully and as required by the party owning or controlling such structure. Before proceeding with the Work of sustaining and supporting such structure, satisfy the ENGINEER that the methods and procedures to be used have been approved by the party owning same.
   2. Assume all risks attending the presence or proximity of all underground and surface structures within or adjacent to the limits of the Work. Be responsible for all damage and expense for direct or indirect injury caused by his Work to
any structure. Repair immediately all damage caused by his Work, to the satisfaction of the owner of the damaged structure.

D. All other existing surface facilities, including but not limited to, guard rails, posts, guard cables, signs, poles, markers, and curbs, which are temporarily removed to facilitate installation of the Work, shall be replaced and restored to their original condition at CONTRACTOR’S expense.

1.5 PROTECTION OF FLOORS AND ROOFS

A. Protect floors and roofs during entire construction period.

B. Proper protective covering shall be used when moving heavy equipment, handling materials or other loads, when painting, handling mortar and grout and when cleaning walls and ceilings.

C. Use metal pans to collect all oil and cuttings from pipe, conduit, or rod threading machines and under all metal cutting machines.

D. Concrete floors less than 28 days old shall not be loaded without written permission of the ENGINEER. No floor, roof or slab shall be loaded in excess of its design loading.

E. Roofs shall not be loaded without written permission of the ENGINEER.

F. Restrict access to roofs and keep clear of existing roofs, except as required by the Work.

G. If access to roofs is required, roofing, parapets, openings and all other construction on or adjacent to roof shall be protected with suitable plywood or other approved means.

1.6 PROTECTION OF INSTALLED PRODUCTS AND LANDSCAPING

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

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

C. Provide coverings to protect equipment and materials from damage.
   1. Cover projections, wall corners and jambs, sills and soffits of openings, in areas used for traffic and for passage of products in subsequent work.
PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++
SECTION 01751

STARTING AND PLACING EQUIPMENT IN OPERATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Initially start-up and place all equipment installed into successful operation according to manufacturer’s written instructions and as instructed by manufacturer’s field representative. Provide all material, labor, tools, equipment, chemicals, lubricants, and expendables required to complete start-up.

B. No system or subsystem shall be started up for continuous operation unless all components of that system or subsystem, including instrumentation, have been tested and proven to be operable as intended by the Contract Documents.

C. General Activities Include:
   1. Cleaning.
   2. Removing temporary protective coatings.
   3. Flushing and replacing greases and lubricants, where required by manufacturer.
   4. Lubrication.
   5. Check shaft and coupling alignments and reset where needed.
   6. Check and set motor, pump and other equipment rotation, safety interlocks, and belt tensions.
   7. Check and correct if necessary leveling plates, grout, bearing plates, anchor bolts, fasteners, and alignment of piping which may put stress on pumping equipment connected to it.
   8. All adjustments required.

D. Provide chemicals and lubricants and all other required operating fluids.

E. Provide fuel, electricity, water, filters, and other expendables required for start-up of equipment, unless otherwise specified.

F. OWNER provide sufficient personnel to assist CONTRACTOR in the start-up, but the prime responsibility for proper mechanical operation shall belong to CONTRACTOR. Manufacturer’s representatives shall be present during initial start-up and operation, unless otherwise acceptable to ENGINEER.

G. Start-up of either the heating or air conditioning systems is dependent upon the time of year that the plant start-up is initiated. CONTRACTOR make arrangements with OWNER to return at the beginning of the next heating or air conditioning season (whichever is applicable) to start the appropriate system.
H. No system, unit process or any piece of equipment shall be started up for continuous operation without the approved Operation and Maintenance Manuals being turned over to the OWNER.

I. Training shall be provided prior to turning the operation of a system, unit process or piece of equipment over to the OWNER. Training shall be scheduled for each plant staff work shift accordingly. Training shall conform to the requirements of Section 01821, Instruction of Operations and Maintenance Personnel.

J. Completion of start-up shall be when the OWNER assumes responsibility for operation of the equipment. If the OWNER does not assume operational responsibility and in the opinion of the ENGINEER start-up tasks are completed, the ENGINEER will notify CONTRACTOR, in writing, of the completion of the start-up period.

1.2 MINIMUM START-UP REQUIREMENTS

A. Bearings and Shafting:
   1. Inspect for cleanliness, and clean and remove all foreign materials.
   2. Verify alignment.
   3. Replace defective bearings and those which run rough or noisy.
   4. Grease as necessary and in accord with manufacturer’s recommendations.

B. Drives:
   1. Adjust tension in V-belt drives, and adjust varipitch sheaves and drives for proper equipment speed.
   2. Adjust drives for alignment of sheaves and V-belts.
   3. Clean and remove foreign materials before starting operation.

C. Motors:
   1. Check each motor for comparison to amperage manufacturer nameplate value.
   2. Correct conditions which produce excessive current flow and exist due to equipment malfunction.

D. Pumps:
   1. Check glands and seals for cleanliness and adjustment before running pump.
   2. Inspect shaft sleeves for scoring.
   3. Inspect mechanical faces, chambers, and seal rings, and replace if defective.
   4. Verify that piping system is free of dirt and scale before circulating liquid through the pump.
E. Valves:
1. Inspect both hand and automatic control valves, and clean bonnets and stems.
2. Tighten packing glands to assure no leakage, but permit valve stems to operate without galling.
3. Replace packing in valves to retain maximum adjustment after system is determined to be complete.
4. Replace packing on any valve that continues to leak.
5. Remove and repair bonnets that leak.
6. Coat packing gland threads and valve stems with a surface preparation of “Moly-Cote” or “Fel-Pro” after cleaning.

F. Verify that control valve seats are free from foreign material and are properly positioned for intended service.

G. Tighten flanges and all other pipe joints after system has been placed in operation.
1. Replace gaskets which show any sign of leakage after tightening.

H. Inspect all joints for leakage.
1. Promptly remake each joint that appears to be faulty; do not wait for rust to form.
2. Clean threads on both parts, and apply compound and remake joints.

I. After system has been placed in operation, clean strainers, drives, pockets, orifices, valve seats and headers in fluid system to assure freedom from foreign materials.

J. Open steam traps and air vents, where used, and remove operating elements.
1. Clean thoroughly, replace internal parts and put back into operation.

K. Remove rust, scale and foreign materials from equipment and renew defaced surfaces.

L. Set and calibrate draft gages of air filters and other equipment.

M. Inspect fan wheels for clearance and balance.
1. Provide factory-authorized personnel for adjustment when needed.

N. Check each electrical control circuit to assure that operation complies with Specifications and requirements and to provide desired performance.

O. Inspect each pressure gage and thermometer for calibration.
1. Replace items which are defaced, broken, or which read incorrectly.

P. Repair any damaged insulation.
Q. Vent gasses trapped in any part of systems.
   1. Verify that liquids are drained from all parts of gas or air systems.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++
SECTION 01752

EQUIPMENT AND SYSTEM
STARTUP AND PERFORMANCE TESTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section contains requirements for CONTRACTOR’S performance in documenting testing Work required under this Contract. In addition, this Section contains requirements for CONTRACTOR’S performance testing during installed startup and performance testing of all mechanical, electrical, instrumentation, and HVAC equipment and systems. This Section supplements, but does not supersede specific testing requirements, found elsewhere in the Contract Documents.

B. Upon completion of design, CONTRACTOR and ENGINEER shall submit a testing, startup and commissioning plan, and schedule to the OWNER for review and approval prior to any system or equipment startup. There shall be at least one 6-hour work sessions to work through the development of a thorough testing plan. A draft testing, startup and commissioning plan shall be submitted to the OWNER and ENGINEER for review and comment at 30 percent of project construction. A revised draft of the plan shall be submitted to the OWNER and ENGINEER for review and comment at 60 percent of project construction. A final plan shall be submitted at 90 percent of project construction.

1.2 QUALITY ASSURANCE

A. CONTRACTOR’S Quality Assurance Manager: Appoint an operations engineer or equally qualified operations specialist as Quality Assurance Manager to manage, coordinate, and supervise CONTRACTOR’S Quality Assurance Program. The Quality Assurance Manager shall have at least five years of total experience, or experience on at least five separate projects, in managing the startup and performance testing of mechanical, electrical, instrumentation, HVAC, and piping systems. Operations engineers shall be graduates from a minimum four year course in mechanical or civil engineering. Operations specialists shall have equivalent experience in plant operation and maintenance. The quality assurance program shall include:

1. A testing plan setting forth the sequence in which all testing Work required under the Contract Documents will be implemented.
2. A documentation program to record the results of all equipment and system tests.
3. An installed startup and performance testing program for all mechanical, electrical, instrumentation, and HVAC equipment and systems installed under this Contract.
4. A calibration program for all instruments, meters, monitors, gages, and thermometers installed under this Contract.

5. A calibration program for all instruments, gages, meters, and thermometers used for determining the performance of equipment and systems installed under this Contract.

6. A testing schedule conforming to the requirements specified in Paragraph 2.2 C., below.

B. For the purposes of this Section, a system shall include all required items of equipment, devices and appurtenances connected in such a fashion as their operation or function complements, protects or controls the operation or function of the others. The Quality Assurance Manager shall coordinate the activities of all subcontractors and suppliers to implement the requirements of this Section.

C. Calibration:
   1. All test equipment (gages, meters, thermometers, analysis instruments, and other equipment) used for calibrating or verifying the performance of equipment installed under this Contract shall be calibrated and certified to within plus or minus two percent of actual value at full scale. Test equipment employed for individual test runs shall be selected so that expected values as indicated by the detailed performance specifications will fall between 60 and 85 percent of full scale. Pressure gages shall be calibrated in accordance with ANSI/ASME B40.1. Thermometers shall be calibrated in accordance with ASTM E77 and shall be furnished with a certified calibration curve.

   2. Liquid flow meters, including meters installed in pipelines with diameters greater than 2-inches shall be calibrated in situ using either the total count or dye dilution methods, as approved by the ENGINEER. Gas flow meters installed in piping systems with diameters greater than 6-inches shall be calibrated in situ using the pitot tube velocity averaging method. Flow meter calibration work shall be performed by individuals skilled in the techniques to be employed. Calibration tests for flow metering systems shall be performed over a range of not less than 10 percent to at least 75 percent of system full scale. At least five confirmed valid data points shall be obtained within this range. Confirmed data points shall be validated by not less than three test runs with results which agree within plus or minus two percent.

D. References:
   1. This Section contains references to the following documents. They are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

   2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or
otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued or replaced.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Title</th>
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<tbody>
<tr>
<td>ANSI/ASME B40.1</td>
<td>Gauges Pressure Indicating Dial Type--Elastic Element</td>
</tr>
<tr>
<td>ASTM E77</td>
<td>Method for Verification and Calibration of Liquid-in-Glass Thermometers</td>
</tr>
<tr>
<td>ASHRAE 41.8</td>
<td>Standard Methods of Measurement of Flow of Gas</td>
</tr>
</tbody>
</table>

1.3 SUBMITTALS

A. Submit for approval the following:

1. A complete description of CONTRACTOR’S plan for documenting the results from the test program in conformance with the requirements of Paragraph 2.2.A., below, including:
   a. Proposed plan for documenting the calibration of all test instruments.
   b. Proposed plan for calibration of all instrument systems, including flow/level meters and all temperature, pressure, weight, and analysis systems.
   c. Sample forms for documenting the results of field pressure and performance tests. Forms located in Section 01331 – Reference Forms.
   d. A list of all CMMS Tag numbers as provided in Section 01630, Computerized Maintenance Management System Tags.

2. The credentials and certification of the testing laboratory proposed by CONTRACTOR for calibration of all test equipment.

3. Pre-startup check out procedures, reviewed and approved by the respective equipment manufacturers.

4. Detailed testing plans, setting forth step-by-step descriptions of the procedures proposed by CONTRACTOR for the systematic startup and performance testing of all equipment and systems installed under this Contract.

5. A schedule and subsequent updates, presenting CONTRACTOR’S plan for startup and performance testing the equipment and systems installed under this Contract.

6. A schedule establishing the expected time period (calendar dates) when CONTRACTOR plans to commence performance testing of the completed systems, along with a description of the temporary systems and installations planned to allow operational testing to take place.

7. A summary of the Quality Assurance Manager’s qualifications, conforming to the requirements of Paragraph 1.2.A, above.
8. All records produced during the startup and testing program.
9. Systems or unit process or any piece of equipment shall not be started up without the approved Operation and Maintenance Manuals being turned over to the OWNER.
10. Written notice to ENGINEER a minimum of 72 hours prior to beginning of any test.

1.4 ADJUSTMENTS

A. Until final tests are completed and approved, make all necessary changes, adjustments and replacements.

PART 2 - PRODUCTS

2.1 GENERAL

A. Prepare test plans and documentation plans as specified in the following paragraphs. The OWNER and ENGINEER will not witness any test work for the purpose of acceptance until all test documentation and calibration plans and the specified system or equipment test plans have been submitted and approved.

2.2 DOCUMENTATION

A. Documentation Plans:
   1. Develop a records keeping system to document compliance with the requirements of this Section. Calibration documentation shall include identification (by make, manufacturer, model, and serial number) of all test equipment, date of original calibration, subsequent calibrations, calibration method, and test laboratory.
   2. Equipment and system documentation shall include date of test, equipment number or system name, nature of test, test objectives, test results, test instruments employed for the test and signature spaces for the OWNER’S and ENGINEER’S witnesses and CONTRACTOR’S Quality Assurance Manager. A separate file shall be established for each system and item of equipment. These files shall include the following information as a minimum:
      a. Metallurgical tests.
      b. Factory performance tests.
      c. Accelerometer recordings made during shipment.
      d. Field calibration tests\(^1\).
      e. Field pressure tests\(^1\).
      f. Field performance tests\(^1\).
      g. Field operational tests\(^1\).

\(^1\)Each of these tests are required even though not specifically noted in detailed specification Section.)
3. Section 01331, Reference Forms, contains samples showing the format and level of detail required for the documentation forms. These are samples only and are not specific to this Project or to any item of equipment or system to be installed under this Contract. Develop test documentation forms specific to each item of equipment and system installed under this Contract. Acceptable documentation forms for all systems and items of equipment shall be submitted for review by the OWNER and ENGINEER as a condition precedent to CONTRACTOR’S receipt of progress payments in excess of 50 percent of the Contract amount. Once the OWNER and ENGINEER has reviewed and approved the forms proposed by CONTRACTOR, produce sufficient forms, at his expense, to provide documentation of all testing work to be conducted as a part of this Contract.

B. Test Plans:
1. Develop test plans detailing the coordinated, sequential testing of each item of equipment and system installed under this Contract. Each test plan shall be specific to the item of equipment or system to be tested. Test plans shall identify by specific equipment or CMMS Tag number each device or control station to be manipulated or observed during the test procedure and the specific results to be observed or obtained. Test plans shall also be specific as to support systems required to complete the test work, temporary systems required during the test work, subcontractors and manufacturers’ representatives to be present and expected test duration. As a minimum, the test plans shall include the following features:
   a. Step-by-step proving procedure for all control and electrical circuits by imposing low voltage currents and using appropriate indicators to affirm that the circuit is properly identified and connected to the proper device.
   b. Calibration of all analysis instruments and control sensors.
   c. Performance testing of each individual item of mechanical, electrical, and instrumentation equipment. Performance tests shall be selected to duplicate the operating conditions described in the Contract Documents.
   d. System performance tests designed to duplicate, as closely as possible, operating conditions described in the Contract Documents.
2. Test plans shall contain a complete description of the procedures to be employed to achieve the desired test environment.
3. As a condition precedent to receiving progress payments in excess of 75 percent of the Contract amount, or in any event, progress payments due to CONTRACTOR eight weeks in advance of the proposed date the CONTRACTOR intends to begin any testing work (whichever occurs earliest in the Project Schedule), have submitted all test plans required for the systematic field performance and operational tests for all equipment and systems installed under this Contract. Once the ENGINEER has reviewed and approved CONTRACTOR’S test plans, reproduce the plans in sufficient number for CONTRACTOR’S purposes and an additional ten copies for
delivery to the ENGINEER. No test work shall begin until CONTRACTOR delivers the specified number of final test plans to the ENGINEER.

C. Testing Schedule: Provide a startup and testing schedule setting forth the sequence contemplated for performing the test work. The schedule shall be a CPM format, plotted against calendar time, shall detail the equipment and systems to be tested, and shall be coordinated with CONTRACTOR’S Progress Schedule specified in Section 01321, Progress Schedule. The schedule shall show the contemplated start date, duration of the test and completion of each test. The test schedule shall be submitted no later than four weeks in advance of the date testing is to begin. The ENGINEER will not witness any testing work for the purpose of acceptance until CONTRACTOR has submitted a test schedule and the ENGINEER approves. The test schedule shall be updated weekly, showing actual dates of test work, indicating systems and equipment testing completed satisfactorily and meeting the requirements of the Contract Documents.

2.3 SYSTEM AND EQUIPMENT PERFORMANCE TESTS

A. Each item of mechanical, electrical, instrumentation and HVAC equipment installed under this Contract shall be tested to demonstrate compliance with the performance requirements of the Contract Documents. Each electrical, instrumentation, mechanical, piping, and HVAC system installed or modified under this Contract shall be tested in accordance with the requirements of the Contract Documents.

B. Once all equipment and systems have been tested individually, proceed with performance testing in accordance with the requirements of Article 3.3, below, simulating actual operating conditions to the greatest extent possible. Install temporary connections, bulkheads and make other provisions to recirculate process fluids or otherwise simulate anticipated operating conditions. During the operational testing period, CONTRACTOR’S Quality Assurance Manager and testing team shall monitor the characteristics of each machine and system and report any unusual conditions to the ENGINEER.

PART 3 - EXECUTION

3.1 GENERAL

A. Quality Assurance Manager: Organize teams made up of qualified representatives of equipment suppliers, subcontractors, CONTRACTOR’S independent testing laboratory, and others, as appropriate, to efficiently and expeditiously calibrate and test the equipment and systems installed and constructed under this Contract. The objective of the testing program shall be to demonstrate, to the OWNER’S and ENGINEER’S complete satisfaction, that the structures, systems, and equipment constructed and installed under this Contract meets all performance requirements and the facility is
Substantially Complete and ready for the commissioning process to commence. In addition, the testing program shall produce baseline-operating conditions for the OWNER to use in a Preventive Maintenance Program.

3.2 CALIBRATION OF FIXED INSTRUMENTS

A. Calibration of analysis instruments, sensors, gages, and meters installed under this Contract shall proceed on a system-by-system basis. No equipment or system performance test shall be performed until all instruments, gages, and meters to be installed in that particular system have been calibrated and the calibration work has been witnessed by the OWNER and ENGINEER.

3.3 PERFORMANCE TESTS

A. General: Performance tests shall consists of the following:
   1. Pressure or leakage tests.
   2. Electrical testing as specified in Division 16, Electrical.
   3. Wiring and piping, individual component, loop, loop commissioning and tuning testing, as specified in Division 17, Instrumentation.
   4. Pre-startup check out for all mechanical and HVAC equipment. Pre-startup check out procedures shall be reviewed and accepted by the respective equipment manufacturer.
   5. Individual and system tests of all mechanical, electrical, HVAC, and instrumentation equipment and systems shall demonstrate compliance with the performance requirements of the Contract Documents.

B. Performance tests for any individual system shall be performed in the order listed above. The order may be altered only on the specific written authorization of the ENGINEER after receipt of a written request, complete with justification for the change in sequence.

C. Pressure and Leakage Tests: Pressure and leakage tests shall be conducted in accordance with applicable Sections. All acceptance tests shall be witnessed by the ENGINEER. Evidence of successful completion of the pressure and leakage tests shall be the ENGINEER’S signature on the test forms prepared by CONTRACTOR.

D. Equipment Checkout: Prior to energization (in the case of electrical systems and equipment), all circuits shall be rung out and tested for continuity and shielding in accordance with the requirements of Division 16, Electrical.

E. Component Calibration and Loop Testing: Prior to energization (in the case of instrumentation system and equipment), all loops and associated instruments shall be calibrated and tested, as specified in Division 17, Instrumentation.
F. Electrical Resistance: Electrical resistance testing shall be in accordance with the requirements of Division 16, Electrical.

G. Pre-Startup Tests: Pre-startup tests shall include the following:
1. Alignment of equipment using reverse dial indicator method.
2. Pre-operation lubrication.
3. Tests in accordance with the manufacturers’ recommendations for pre-start preparation and pre-operational check out procedures.
4. Pre-Startup tests shall conform to the requirements of Section 01751, Starting and Placing Equipment in Operation.

H. System Performance Tests:
1. General: Once all affected equipment has been subjected to the required pre-operational check out procedures and the ENGINEER has witnessed and has not found deficiencies in that portion of the Work, individual items of equipment and systems may be started and operated under simulated operating conditions to determine, as nearly as possible, whether the equipment and systems meet the requirements of these specifications.
2. For each system performance test phase, the equipment shall be operated a sufficient period of time to determine machine operating characteristics, including noise, temperatures and vibration; to observe performance characteristics; and to permit initial adjustment of operating controls and shall last no less than 5 continuous days. When testing requires the availability of auxiliary systems such as looped piping, electrical power, compressed air, control air, or instrumentation which have not yet been placed in service, provide acceptable substitute sources, capable of meeting the requirements of the machine, device, or system, at no additional cost to the OWNER. Disposal methods for test media shall be subject to review and approval by the OWNER and ENGINEER. During the performance test period, obtain baseline-operating data on all equipment with motors greater than one horsepower to include amperage, bearing temperatures, and vibration. The baseline data shall be collected for the OWNER to enter in a Preventive Maintenance Program.
3. Test results shall be within the tolerances set forth in the detailed specification Sections of the Contract Documents. If no tolerances have been specified, test results shall conform to tolerances established by recognized industry practice. Where, in the case of an otherwise satisfactory performance test, any doubt, dispute, or difference should arise between the ENGINEER and CONTRACTOR regarding the test results or the methods or equipment used in the performance of such test, then the ENGINEER may order the test to be repeated. If the repeat test, using such modified methods or equipment as the ENGINEER may require, confirms the previous test, then all costs in connection with the repeat test will be paid by the OWNER. Otherwise, the costs shall be borne by CONTRACTOR. Where the results of any performance test fail to comply with the contract requirements for such test, then such repeat tests as may be necessary to achieve
the contract requirements shall be made by CONTRACTOR at his expense.

4. Provide, at no expense to the OWNER, all power, fuel, compressed air supplies, water, and chemicals, all labor, temporary piping, heating, ventilating, and air conditioning for any areas where permanent facilities are not complete and operable at the time of functional tests, and all other items and work required to complete the functional tests. Temporary facilities shall be maintained until permanent systems are in service.

5. Should the testing period be halted for any reason, the operational testing program shall be repeated, until the specified continuous period has been accomplished without interruption. All process units shall be brought to full operating conditions, including temperature, pressure, flow and level.

6. Record Documents shall conform to the requirements of Section 01782, Record Documents, of facilities involved shall be accepted and ready for turnover to the OWNER 72 hours prior to operational testing.

7. Phase Retesting: If under test, any portion of the Work should fail to fulfill the Contract requirements and is adjusted, altered, renewed, or replaced, tests on that portion when so adjusted, altered, removed, or replaced, together with all other portions of the Work as are affected thereby, shall, unless otherwise directed by the ENGINEER, be repeated within reasonable time and in accordance with the specified conditions. Pay to the OWNER all reasonable expenses incurred by the OWNER, including the costs of the ENGINEER, as a result of repeating such tests.

8. Post-Test Inspection: Once testing has been completed, all machines shall be rechecked for proper alignment and realigned, as required. All equipment shall be checked for loose connections, unusual movement, or other indications of improper operating characteristics. Any deficiencies shall be corrected to the satisfaction of the ENGINEER. All machines or devices which exhibit unusual or unacceptable operating characteristics shall be disassembled and inspected. Any defects found during the course of the inspection shall be repaired or the specific part or entire equipment item shall be replaced to the complete satisfaction of the ENGINEER, at no additional cost to the OWNER.

9. After the CONTRACTOR has demonstrated and proven to the ENGINEER that all system are functioning properly and has been documented in the approved testing and startup plan, then the CONTRACTOR shall demonstrate this reliability to the OWNER. The OWNER demonstration shall be executed as agreed upon and documented per the approved testing and startup plan.

I. Operational Availability Demonstration
1. Operational Availability Demonstration (OAD) shall begin following completion of the integrated system field test as specified above and shall continue until a time frame has been achieved wherein the equipment, instrumentation and control system hardware availability meets or exceeds 99.7 percent for 7 consecutive days and no system failures have occurred which
result in starting the OAD over again. During the OAD the system shall be available to plant operating personnel for use in normal operation of the Plant.

2. For the purpose of the Operational Availability Demonstration, the system shall be defined as consisting of the following systems and components:
   a. Decant Pump Station No. 2 Pumps.

3. The conditions listed below shall constitute system failures which are considered critical to the operability and maintainability of the system. The Operational Availability Demonstration shall be terminated if one or more of these conditions occur. Following correction of the problem, a new 7 consecutive day OAD shall begin.
   a. Failure to repair a hardware or software problem within 120 consecutive hours from the time of notification of a system failure.
   b. Recurrent hardware problems: If the same type of problem occurs three times or more.

4. The following conditions shall constitute a system failure in determining the system availability based on the equation specified in Paragraph 1.5.E., below
   a. Failure of equipment to start or stop.
   b. Loss of communications between devices on the communications network.
   c. Failure of one or more input/output components.
   d. Failures of any type affecting ten or more input/output points simultaneously.
   e. Failure of any type affecting one or more regulatory control loops or sequential control strategies thereby causing a loss of the automatic control of the process variable or process sequence operation.
   f. Failure of power supply. Where redundant power supplies are provided, failure of one power supply shall not constitute a system failure provided the backup power supply operates properly and maintains supply power. Failure of the backup supply to operate properly and maintain supply power shall constitute a system failure.

5. The system availability shall be calculated based on the following equation:

\[ A = \frac{MTBF}{MTBF + MTTR} \times 100\% \]

Where:
A = system availability in percent
MTBF = average time interval between consecutive system failures
MTTR = mean time required to repair system failures

6. Time between failures shall be the period between the time that a reported system failure has been corrected and the time of subsequent notification of CONTRACTOR that another system failure has occurred in terms of operating hours.

7. Time to repair shall be the period between the time that CONTRACTOR is notified of a system failure and the time that the system has been restored to
proper operation in terms of hours with an allowance for the following dead times which shall not be counted as part of the time to repair period.

a. Actual travel time for service personnel to get to the plant site up to a maximum of six hours from the time CONTRACTOR is notified of a system failure.

b. Time for receipt of spare parts to the plant site once requested up to a maximum of 24 hours. No work shall be done on the system while waiting for delivery of spare parts.

c. Dead time shall not be counted as part of the system available period. The dead time shall be logged and the duration of the OAD extended for an amount of time equal to the total dead time.

8. Completion of a 7 consecutive day period without any restarts of the OAD and with a system availability in excess of 99.7 percent will constitute acceptance of the System by OWNER.

9. Submit a request of acceptance after 7 consecutive day period without any restarts to the ENGINEER for approval.

10. All parts and maintenance materials required to repair the system prior to completion of the OAD shall be supplied by CONTRACTOR, at no additional cost to OWNER. If parts are obtained from the contractual spare parts inventory, they shall be replaced to provide a full complement of parts as specified.

11. A System Malfunction/Repair Reporting Form shall be completed by the OWNER and ENGINEER to document system failures, to record CONTRACTOR notification, arrival and repair times and CONTRACTOR repair actions. Format of the form shall be developed and agreed upon prior to the start of the OAD.

++ END OF SECTION ++
SECTION 01781

OPERATIONS AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide Operation and Maintenance Data in the form of instructional manuals for use by the OWNER'S personnel for:
   1. All equipment and systems.
   2. All valves, gates and related accessories.
   3. All instruments and control devices.
   4. All electrical gear.

B. Training or start-up on any system, process, or piece of equipment shall not be allowed until Operation and Maintenance Manuals are reviewed by the ENGINEER and the Operation and Maintenance Manuals have been turned over and approved by OWNER as per 1.1.D.3.

C. Definitions:
   1. Operation and Maintenance Data:
      a. The term "Operation and Maintenance Data" includes all product related information and documents which are required for preparation of the plant operation and maintenance manual. It also includes all data which shall accompany said manual as directed by current regulations of any participating government agency.
      b. Required Operation and Maintenance Data includes, but is not limited to, the following:
         1) A copy of the specification section in which the Operations and Maintenance Manual applies.
         2) Complete, detailed written operating instructions for each product or piece of equipment including equipment function; operating characteristics; limiting conditions; operating instructions for startup, normal and emergency conditions; regulation and control; and shutdown.
         3) Complete, detailed written preventive maintenance instructions as defined below.
         4) Recommended spare parts lists, by generic title and identification number, and local sources of supply for parts.
         5) Written explanations of all safety considerations relating to operation and maintenance procedures, including Material Safety Data Sheets (M.S.D.S.’s).
6) Provide the completed Equipment Manufacturer/Vendor/Installer Form. Form to include: name, address, phone number, fax number, e-mail address, and website of manufacturer, manufacturer's local service representative (at a minimum), and subcontractor or installer. Form is located in Section 01331 – Reference Forms, form number 01600-C. If multiple manufacturers of equipment are provided in a single manual, provide a separate form for each.

7) Copy of warranty bond and service contract, as applicable.

8) As-built circuit diagrams, wiring diagrams, schematics and functional drawings, as applicable, and either a nameplate drawing or a copy of nameplate.

9) Control Panel Drawings as required by Specification 17260 are to be provided in hard copy and electronically in AutoCAD version 2004 or newer.

10) Final test data, where applicable, shall be submitted as an appendix when completed.

11) Disassembly, reassembly, installation, alignment, adjustment, and checking instructions.

12) Provide installation data in accordance with Section 01731, Installation Data.

13) Written reference to CMMS Tag number, as specified under Section 01752, Equipment and System Startup and Performance Testing, paragraph 1.3.A.1.d., and as provided in Section 01630, Computerized Maintenance Management System Tags.

14) Provide the completed Equipment Information Forms, in accordance with the requirements of Section 01600, General Equipment Provisions. Form is located in Section 01331 – Reference Forms, form number 01600-A. If multiple manufacturers of equipment are provided in a single manual, provide a separate data sheet for each.


16) Material Safety Data Sheets (M.S.D.S.’s) for all fluids, oils, chemicals, and volume of each liquid used by each piece of equipment being supplied.

2. Preventive Maintenance Instructions:
   a. The term "preventive maintenance instructions" includes all information and instructions required to keep a product or piece of equipment properly lubricated, adjusted and maintained so that the item functions economically throughout its full design life.
   b. Preventive maintenance instructions include, but are not limited to, the following:
      1) A written explanation with illustrations for each preventive maintenance task.
      2) Recommended schedule for execution of preventive maintenance
tasks.
3) Lubrication charts.
4) Table of alternative lubricants.
5) Trouble shooting instructions.
6) List of required maintenance tools and equipment.
7) Special tools.

D. Submittals:
1. General:
a. Submit operations and maintenance data to the ENGINEER within 30 days after approval of Shop Drawings, unless noted otherwise.
b. Final approval of all O&M Manuals will only be provided after the OWNER’s DOCUMENTS MANAGER has reviewed and approved the individual final O&M Manuals. A copy of the signed Final Approval checklist shall be included in the O&M Manuals provided to the OWNER.

2. Preliminary Copies:
a. Number of preliminary copies: 3 hard copy(s) and 1 soft copies of each O&M Manual shall be submitted to the ENGINEER for review. The O&M Manual shall conform to the requirements as specified herein.
b. Each preliminary O&M Manual must be submitted to and reviewed by ENGINEER, and approved by the OWNER 30 days prior to equipment start-up. ENGINEER to determine timeline for the submittal review process.

3. Final Copies:
a. Number of Final Copies: 3 hard copy(s) and 1 soft copies of each manual.
b. 30 days prior to placing the equipment into service submit all final hard copies and soft copies of the approved O&M Manual (except for field test data) to the ENGINEER.
c. Soft copy shall be on a CD, “pdf” format – including “character recognition”, and shall include all information provided in hard copy. The pdf file shall be a complete electronic copy of the hardcopy with bookmarks set for each tab in the hardcopy. The size of the pdf file shall be limited to 50 Mb and labeled with the title of the manual and volume number. Volumes shall be organized in a rational manner with the separation at a bookmark tab. CD’s must be properly labeled with the following: Facility Name, Project Title, WS number, Specification Section # and Title of Manual. Labels must be computer generated. Hand written labels are not acceptable.

4. Format Requirements:
a. Use 8-1/2-inch by 11-inch quality paper of a minimum 20 pound. Larger drawings or illustrations are acceptable if neatly folded to the size of 8-1/2-inch by 11-inch and each drawing or illustration placed inside of an individual clear plastic or vinyl sheet protector.
b. All text must be legible typewritten or machine printed originals or high
quality copies of same. Manuals that contain copies that are not clear, not completely legible, off-center, skewed, or where text or drawings are cut by the binding holes shall be subject to disapproval. Pages that contain approval or date stamps, comments or other markings that cover any portion of text or drawing are unacceptable. Electronically transmitted facsimile (fax) copies are also unacceptable.

c. Each page shall have a binding margin of approximately 1-1/2-inches and be punched for placement in a “D-ring” loose-leaf binder. Provide minimum 1-inch size or larger, white in color, D-ring binders. Binders shall not be filled to more than 3/4 maximum of their capacity. Non-uniform binders will not be acceptable. Identify each binder with the following:
   1) Title "OPERATING AND MAINTENANCE INSTRUCTIONS".
   2) Title of Project.
   3) Specification Section Number and Title.
   4) Name of the Provider of the Manual.
   5) WSD WS#

d. Coordinate with the ENGINEER and OWNER to develop a comprehensive, practical, and consistent indexing system for the Operations and Maintenance Manuals. The ENGINEER and the OWNER shall review the indexing system before any manuals are submitted in draft form.

e. Use dividers and indexed tabs between major categories of information such as operating instructions, preventive maintenance instructions, or other. When necessary, place each major category in a separate binder.

f. Provide a Table of Contents for each binder. The Table of Contents will have an appendix place holder for the final Test Data Forms. The soft copy content shall be identical to the hard copy’s Table of Contents.

g. Identify products by their functional names in the table of contents and at least once in each chapter or Section. Thereafter, abbreviations and acronyms may be used if their meaning is explained in a table in the back of each binder. Use of model or catalog numbers or letters for identification is not acceptable.

h. Indicate all components of the equipment on catalog pages by highlighting or some other clearly definable medium for ease of identification.

5. Changes after Installation:
   a. Final test data, changes and/or upgrades made to the systems after initial installation and during the start-up and commissioning phases, including equipment information and as-built wiring schematics, shall be submitted as an appendix to the Operations and Maintenance Manuals.

b. 2 copies of all revised Shop Drawings and Documentation that represent changes made during start-up and commissioning shall be submitted to the ENGINEER to replace initial drawings and documentation contained in the Operations and Maintenance Manuals.
1.2 OPERATION AND MAINTENANCE

A. Operation and Maintenance data shall be provided for the following equipment.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Specification Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decant Pump Station No.2 Pumps</td>
<td>11318</td>
</tr>
<tr>
<td>Decant PS No.2 Sump Pumps</td>
<td>15441</td>
</tr>
<tr>
<td>Decant PS No.2 Exhaust Fan</td>
<td>15832</td>
</tr>
</tbody>
</table>

1.3 OPERATIONS AND MAINTENANCE TRANSMITTAL FORM

A. Upon receipt of the Vendor Operations & Maintenance Manual from the Manufacturer /Supplier, complete the CONTRACTOR review and submit the Operations and Maintenance Transmittal Form as specified in Section 01331, Form 01781-A to the ENGINEER. ENGINEER to complete the form and attach to the Manual when delivered to the OWNER.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)
SECTION 01782

RECORD DOCUMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Maintain and provide the ENGINEER with Record Documents as specified below, except where otherwise specified or modified in Division 2, Site Work, through Division 17, Instrumentation.

B. Definitions

1. Contract Documents: The contract documents include the drawings, specifications, and addenda developed and furnished to the CONTRACTOR at the beginning of construction.

2. As-Built Drawings: As-built drawings are an annotated set of drawings prepared by the CONTRACTOR. They show, in red, as-constructed changes to the original Contract Documents that have been made during the construction process. The As-Built Drawings may include supplemental drawings to provide the necessary detail, comply with project standards or where annotation would otherwise be impractical.

3. Record Drawings: Record Drawings are prepared by the ENGINEER and reflect as-constructed changes that the CONTRACTOR annotated in the As-Built Drawings.

4. Record Documents: The Record Documents include Record Drawings, specifications, addenda, approved shop drawings, samples, photographs, change orders, other modifications to the Contract Documents, test records, survey data, field orders, Request for Information, submittals and all other documents pertinent to the CONTRACTOR’S Work.

C. Maintenance of Documents:

1. Three sets of black line sets of plans, including any Addenda, of the Drawings will be furnished to CONTRACTOR by the OWNER.

2. Maintain in CONTRACTOR’S field office in clean, dry, legible condition complete sets of the following: Drawings, Specifications, Addenda, approved Shop Drawings, Samples, Photographs, Change Orders, other modifications of the Contract Documents, test records, survey data, Field Orders, and all other documents pertinent to CONTRACTOR’S Work.

3. Provide files and racks for proper storage and easy access. File in accordance with filing format of Construction Specification Institute (CSI), unless otherwise approved by ENGINEER.

4. Make documents available at all times for inspection by ENGINEER and
5. Record Documents shall not be used for any other purpose and shall not be removed from CONTRACTOR’S office without ENGINEER’S approval.

6. Any contractually required testing provided by others shall be thoroughly documented by the CONTRACTOR and maintained with the project Record Documents. All testing results shall be maintained in their own separate log for the project; being kept current weekly and made readily available for viewing at any time.

D. Marking System: Changes, revisions, additions and deletions, to the record set of Drawings shall be marked in Red.

E. Recording:
1. Submit as-built drawings and make a record of the locations of all work completed as part of the project. The as-builts must indicate the locations of the beginning(s) and end(s) of the construction, and all valves, fire hydrants, pipe fittings, service connections and appurtenances. They must also show locations and elevations where significant elevation changes occur or changes in direction in all pipe alignments. Their locations must be shown by stationing and dimensioning from appropriate monument lines or in their absence appropriate lot lines, property lines or easement line references.

2. Label the Cover Sheet, Index and each supplemental sheets of each document “PROJECT RECORD” in 2-inch high printed letters.

3. Keep the As-Built Drawings current. CONTRACTOR’S refusal, failure or neglect to maintain current As-Built Drawings shall constitute sufficient basis for the ENGINEER to recommend the withholding of some or all of any payment due.

4. Do not permanently conceal any Work until required information has been recorded.

5. Drawings: Legibly mark to record actual construction including:
   a. Depths of various elements of foundation in relation to datum.
   b. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
   c. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
   d. Field changes of dimensions and details.
   e. Changes made by Change Order or Field Order.
   f. Details not on original Drawings.

6. Specifications and Addenda: Legibly mark up each Section to record:
   a. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
   b. Changes made by Change Order or Field Order.
   c. Other matters not originally specified.
F. Record Drawings:
   1. As-Build Drawings shall be prepared for all the Work included in the Contract. On a weekly basis, furnish to the ENGINEER a full size annotated copy of the As-Build Drawings that include changes from the previous week’s As-Build Drawing submittal. Annotations shall include redlined “clouds” of only those changes from the previous week’s submittal. The redlined As-Build Drawings shall show the actual in-place installation of the items installed under this Contract. The redlined As-Build Drawings shall show the Work in plan and sections as required for clarity with reference dimensions and elevations that will be used to develop complete Record Drawings.

   2. Develop and furnish to the ENGINEER, redlined Instrumentation and Control and Electrical Drawings showing one line diagrams with all conduit and wire sizes shown of the distribution systems and the actual in-place grounding system, lighting arrangement, motor control centers, corrected wiring diagrams, equipment and conduit and cable plans.
      a. The Contract Drawings may be used as a starting point in developing these Instrumentation and Control and Electrical As-Build Drawings. Subcontractor and manufacturer drawings may be included in this drawing package. The drawing package must be fully integrated and include the necessary cross references between drawings. The drawing package shall include interconnection and termination details to equipment furnished under this Contract.
      b. All As-Build Drawings must be submitted on a weekly basis for approval of the ENGINEER. This shall include the following composite drawings for the system being furnished:
          1) Schematic (Elementary) Diagrams: This shall include, but not be limited to, complete schematics including items furnished by others for the following:
             a) Motor Control Circuits for Starters furnished under this Contract.
             b) HVAC Control Panels furnished under this Contract.
          2) Wiring (Connection) Diagrams: These shall be included for all pre-wired equipment furnished under this Contract.
          3) Interconnection Diagrams: These shall include all interconnections to be furnished under this Contract.
          4) Conduit and Cable Schedules: These shall include all conduit and cable furnished under this Contract.
          5) Dimension of Outline Drawings: These shall include all equipment furnished under this Contract.
          6) Power and Lighting Layout Drawings: These shall include all conduits and wiring furnished under this Contract.

   3. In addition to the redlined As-Build Drawings, prepare and submit CADD “.dwg” files, version 2004 or later (--1--), for all supplemental drawings used to complete the As-Build Drawings.
4. Survey results shall be posted to the as-builts on a weekly basis.

G. Submittals:
1. Acceptance of CONTRACTOR’S monthly application for payment shall be dependent on the ENGINEER’S acceptance and agreement that CONTRACTOR’S As-Build Drawings and weekly submittals are complete, thorough and acceptable in showing all Work up through and including such work as CONTRACTOR is claiming for completion and payment on CONTRACTOR’S application for payment. Any items which do not appear on the As-Build Drawings in complete and acceptable form shall not be paid for in CONTRACTOR’S monthly payment.

2. Examination by the ENGINEER of CONTRACTOR’S As-Build Drawings will be made on a weekly basis to determine completion for consideration of monthly pay application. Also, make available all As-Build Drawings at all times to the ENGINEER for examination.

3. Prior to Completion of the Work, deliver final As-Build Drawings to ENGINEER. Substantial completion will not be made until satisfactory final As-Build Drawings are received by ENGINEER.

4. Accompany final and weekly submittals with transmittal letter containing:
   a. Date.
   b. Project title and number.
   c. CONTRACTOR’S name and address.
   d. Title and number of each As-Build Drawings.
   e. Certification that each document as submitted is complete and accurate.
   f. Signature of CONTRACTOR, or his authorized representative.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++
SECTION 01783

SPARE PARTS AND MAINTENANCE MATERIALS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Submit a complete list of all spare parts required for the project for review and comments to the ENGINEER and OWNER by no later than 50 percent of the project construction completion. The list shall include details such as equipment identification, part description, manufacture, and manufacturer part number, location in system, local vendor, storage requirements, storage location, and approximate cost. This completed list will be used to inventory all parts at time of turnover to the OWNER.

B. Spare parts and materials required to be supplied in the Contract Documents shall be furnished in manufacturer’s unopened cartons, boxes, crates or other protective covering suitable for preventing corrosion or deterioration for the maximum length of storage which may be normally anticipated. They shall be clearly marked and identified as to the name of manufacturer or supplier, applicable equipment, part number, description and location in the equipment. All parts shall be protected and packaged for a shelf life of at least ten years.

C. During construction, store parts in buildings or trailers with floor, roof and closed sides and in accordance with manufacturers’ recommendations. Protect from weather, condensation and humidity.

D. Parts and materials shall be delivered to the OWNER upon Substantial Completion of the Work or during the commissioning period of the system. Until that occurs, place spare parts in permanent storage rooms or areas approved by the OWNER. The turnover procedures shall be developed by the ENGINEER.

E. Provide a letter of transmittal along with the Spare Parts Receiver Form 01783-A in Specification 01331 – Reference Forms.

F. Full responsibility for loss or damage to parts and materials until they are transmitted to the OWNER, belongs to CONTRACTOR.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++
SECTION 01810

COMMISSIONING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section Includes: Responsibility of the OWNER, ENGINEER and CONTRACTOR during the Commissioning Phase(s) of the Project.

B. Start-up and Commissioning of the Work, or a specified part of the Work, under this Project shall be as described in Section 01111, Schedule of Completion and Section 01143, Coordination with OWNER’S Operations. Work under this Section shall not start until the Work under Section 01111, Schedule of Completion, Section 01143, Coordination with OWNER’S Operation, Section 01751, Starting and Placing Equipment in Operation, Section 01752, Equipment and System Start-Up and Performance Testing; Section 01781, Operation and Maintenance Data, Section 01782, Record Documents and Section 01821, Instruction of Operations and Maintenance Personnel. Also, Special Tests as defined under the individual technical specifications, Divisions 0 to 18 has been completed; and Notice of Substantial Completion for the Work as defined in the Supplementary Conditions has been completed and issued by the ENGINEER. Spare parts shall also be on-site and accepted prior to Commissioning.

1.2 DEFINITIONS

A. Commissioning: The sequential process in which a newly constructed facility is put into successful operation.

B. Successful Operation: The resultant operation of all the processes and related controls in a manner that is consistent with the Contract Documents.

C. Manual Operational Mode: This operational mode represents the lowest level of control philosophy utilized in the plant instrumentation and control system. For all practical purposes, it means that an operational control decision requiring equipment or process monitoring or control will require an individual to physically go to the local control for the associated task in order to operate the facility. In the manual operational mode, the focus will be on verifying that the equipment and processes function correctly, independent of the instrumentation system and control system. The estimated duration of the manual commissioning period is 25 percent of the total Work/Work area commissioning duration.
D. Semi-Automatic Operational Mode: The highest level of control philosophy utilized in the plant instrumentation and control system.

1.3 SUBMITTALS

A. Preventive and Unscheduled Maintenance Plan: Submit detailed plan prior to start of Commissioning for providing all preventive and unscheduled maintenance of all equipment and facilities in the plant throughout the entire commissioning phase of the project.

B. OWNER’S Personnel Training Schedule and Plan: Submit detailed plan and schedule for training OWNER’S personnel in accordance with Section 01821, Instruction of Operations and Maintenance Personnel.

1.4 REQUIREMENTS

A. Commissioning process will commence after issuance of the Work/Work area Notice of Substantial Completion to CONTRACTOR.

B. The commissioning process for the Project will consist of the following:

<table>
<thead>
<tr>
<th>Work/Work Area</th>
<th>Commissioning Requirements</th>
<th>Commissioning Duration (Calendar Days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decant PS No.2 Pumps and Sump Pumps</td>
<td>All equipment in manual (local) and semi-automatic modes of operation</td>
<td>5 consecutive uninterrupted days</td>
</tr>
</tbody>
</table>

C. Items required to be completed prior to the start of Commissioning include:
1. All Vendor Operations & Maintenance Manuals.
2. All required Training.
3. All required spare parts.
4. After approval of the Specification 01630 - Computerized Maintenance Management System Tags, CONTRACTOR shall provide and install all tags.
5. Any other items required under the contract.

D. During the course of the Commissioning Process, the ENGINEER and OWNER will evaluate design related issues and recommend design modifications which shall be implemented by CONTRACTOR through the Change Order process.

E. No system or subsystem shall be started up for continuous operation unless all components of that system or subsystem, including instrumentation, have been tested and proven to be operable as intended by the Contract Documents.
1.5 RESPONSIBILITIES

A. Responsibilities listed do not relieve CONTRACTOR from all other responsibilities and duties associated with project closeout as defined in Division 0 and Division 1, General Requirements of the Specifications.

B. CONTRACTOR’S Responsibilities during the Commission Process:
   1. Provide on call service (24 hours per day and seven days per week), which includes all staff, labor, materials, equipment and appurtenances required for carrying out CONTRACTOR’S commissioning duties described below.
   2. All Change Order work resulting from the evaluation of design-related issues by the ENGINEER and OWNER.
   3. All preventive and unscheduled maintenance of all equipment and facilities. This shall include, but not be limited to the following:
      a. Providing all lubricants.
      b. Lubrication of all equipment in accordance with Manufacturer’s recommendations.
      c. Perform all Manufacturer recommended preventive maintenance, including instrument calibrations.
      d. Exercise all equipment not in use during Commissioning phase.
      e. Repair all failed equipment.
      f. Periodic check of all equipment alignment, vibration, and noise levels to ascertain conformance with Specifications.
      g. Provide all parts required for equipment repair.
      h. Provide all tools and miscellaneous equipment required for equipment repair.
      i. Administration/logging/documentation of all preventive maintenance and repair work.
      j. Cleanup associated with equipment failure and repair.
      k. Daily cleanup of buildings and site.
      l. Landscaping maintenance.
      m. Roadway cleanup and maintenance.
      n. Replacement of all HVAC filters.
   4. Warranty related issues/items.
   5. Other contractual requirements including, but not limited to, incomplete Work list.

C. OWNER’S Responsibilities during the Commissioning Process:
   1. Perform all laboratory analysis required for plant operations.
   2. Assisting ENGINEER in the evaluation of design related issues and recommendations of modifications to be implemented by CONTRACTOR through the change order process.

D. ENGINEER’S Responsibilities during Commissioning Process:
1. Provide staff for Commissioning Phases.
2. Assist OWNER with Operation of facilities.
4. Provide liaison and coordination between CONTRACTOR and OWNER’S activities.
5. Administer Change Order work performed by CONTRACTOR.

E. Based upon the data compiled during the commissioning period modifications may be required. The ENGINEER and OWNER may issue a request for proposal to modify the Work, to change design or process related issues. A respond to these requests is expected. Appropriate cost and time adjustment will be made to address the proposed change.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

+ + END OF SECTION + +
SECTION 01821

INSTRUCTION OF OPERATIONS AND MAINTENANCE PERSONNEL

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide the services of factory-trained maintenance specialists to instruct OWNER’S operations and maintenance personnel in the recommended operation and the preventive maintenance procedures for equipment specified in the equipment Sections.

B. The qualifications of specialists shall be subject to approval by ENGINEER.

C. Coordinate these services at times acceptable to OWNER and ENGINEER, with a minimum of 14 days prior notice.

D. Manufacturer shall provide a combination of classroom and field training. All training shall be conducted at the Facility, unless otherwise stated in the equipment Sections. Class size shall be limited to no more than 15 trainees. Manufacturer shall provide training for all plant shifts, or as approved by OWNER.

E. Manufacturer shall allow any and all training sessions to be videotaped by OWNER.

F. Section 01600, General Equipment Provisions, Section 01620, Installation of Equipment, Section 01751, Starting and Placing Equipment in Operation, and Section 01752, Equipment and System Startup and Performance Testing, includes, additional requirements for manufacturer’s and supplier’s field and test data.

G. Instruction of OWNER’S personnel shall commence only after the equipment has been started, approved Operation and Maintenance Manuals have been turned over to the OWNER, and acceptance tests have been completed according to the provisions in Section 01751, Starting and Placing Equipment in Operation, and Section 01752, Equipment and System Startup and Performance Testing.

H. Submit a copy of this Section 01821, Instruction of Operations and Maintenance Personnel, to all manufacturers of equipment for this contract.

1.2 SUBMITTALS

A. The CONTRACTOR shall submit to the ENGINEER for review and comment, by no later than 60 percent of project construction, a complete list of all training courses
and duration of each training course required in the specifications and contract documents.

B. No later than 75 percent project construction completion the Manufacturer or Manufacture Representative shall develop and submit for approval the following:
   1. Proposed Lesson Plan for each scheduled instruction 30 days prior to commencement of training. Lesson plans shall be approved minimum of 15 days prior to scheduled instruction.
   2. Credentials of their designated operations and maintenance instructor shall include a brief resume and specific details of the instructor’s experience pertaining to; operation of, maintenance of, and training for the equipment specified.
   3. Training Request Form: Submit the Training Request Form to the ENGINEER 30 days prior to the requested training date. Form is located in Section 01331 – Reference Forms, form number 01821-B.
   4. There shall be separate “Operations” and “Maintenance” staff training.

1.3 INSTRUCTION LESSON PLAN

A. Manufacturer’s proposed Lesson Plan shall include the elements presented in the outline of Instruction Lesson Plan in Paragraph 1.3.D., below, of this Section. Specific components and procedures shall be identified in the proposed Lesson Plan.

B. Manufacturer’s proposed Lesson Plan shall detail specific instruction topics. Training aids to be utilized in the instruction shall be referenced and attached where applicable to the proposed Lesson Plan. “Hands-On” demonstrations planned for the instruction shall be described in the Lesson Plan.

C. The manufacturer shall indicate the estimated duration of each segment of the training Lesson Plan.

D. Instruction Lesson Plan shall include the following as a minimum:
   1. Equipment Operation:
      a. Describe equipment’s operating (process) function.
      b. Describe equipment’s fundamental operating principals and dynamics.
      c. Identify equipment’s mechanical, electrical and electronic components and features.
      d. Identify all support equipment associated with the operation of subject equipment (e.g., air intake filters, valve actuators, motors).
      e. Recommend standard operating procedures to cover start-up, routine monitoring and shutdown of the equipment.
   2. Detailed Component Description:
      a. Identify and describe in detail each component’s function.
b. Where applicable, group related components into subsystems. Describe subsystem functions and their interaction with other subsystems.
c. Identify and describe in detail equipment safety interlocks.

3. Equipment Preventive Maintenance (PM):
   a. Describe PM inspection procedures required to:
      1) Perform an inspection of the equipment in operation.
      2) Spot potential trouble symptoms and anticipate breakdowns.
      3) Forecast maintenance requirements (predictive maintenance).
   b. Define the recommended PM intervals for each component.
c. Provide lubricant and replacement part recommendations and limitations.
d. Describe appropriate cleaning practices and recommend intervals.
e. Identify and describe the use of special tools required for maintenance of the equipment.
f. Describe component removal/installation and disassembly/assembly procedures.
g. Perform at least two “hands-on” demonstrations of preventive maintenance procedures.
h. Describe recommended measuring instruments and procedures, and provide instruction on interpreting alignment measurements, as appropriate.
i. Define recommended torquing, mounting, calibration and/or alignment procedures and settings, as appropriate.
j. Describe recommended procedures to check/test equipment following a corrective repair.

4. Equipment Troubleshooting:
   a. Define recommended systematic troubleshooting procedures.
b. Provide component specific troubleshooting checklists.
c. Describe applicable equipment testing and diagnostic procedures to facilitate troubleshooting.

1.4 TRAINING AIDS

A. The manufacturer’s instructor shall incorporate training aids as appropriate to assist in the instruction. As a minimum, the training aids shall include text and figure handouts. Other appropriate training aids are:
   1. Audio-Visual Aids (e.g., films, slides, videotapes, overhead transparencies, posters, blueprints, diagrams, catalogue sheets).
   2. Equipment cutaways and samples (e.g., spare parts and damaged equipment).
   3. Tools (e.g., repair tools, customized tools, measuring and calibrating instruments).
B. The manufacturer’s instructor shall utilize descriptive class handouts during the instruction. Photocopied class handouts shall be good quality reproductions. Class handouts should accompany the instruction with frequent reference made to them. Customized handouts developed especially for the instruction are encouraged. Handouts planned for the instruction shall be attached with the manufacturer’s proposed Lesson Plan.

1.5 “HANDS-ON” DEMONSTRATIONS

A. The manufacturer’s instructor shall present “hands-on” demonstrations of operations and maintenance of the equipment for each scheduled group. The proposed “hands-on” demonstrations should be described in the manufacturer’s proposed Lesson Plan.

1.6 TRAINING SCHEDULE

A. Each manufacturer shall provide as a minimum the following hours of training. Travel time and expenses are responsibility of manufacturer and are not included in training schedule time.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Section</th>
<th>Training Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sump Pumps</td>
<td>15441</td>
<td>2</td>
</tr>
<tr>
<td>Decant Pumps</td>
<td>11318</td>
<td>4</td>
</tr>
</tbody>
</table>

B. The plant operators work on a shift schedule. Develop the training schedule to account for training classes for each shift.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++
PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
1. Provide all labor, materials, tools, equipment and incidentals as shown on the Drawings, specified and required to furnish and apply paint systems.
2. Responsibility for proper surface preparation and painting of all new and existing interior and exterior items and surfaces throughout the Project areas included under this Section and other Sections belongs to CONTRACTOR.
3. Extent of painting is specified and includes the following: Painting shown in schedules may not provide CONTRACTOR with complete indication of all painting Work. CONTRACTOR refer to Article 2.1, below, where all surfaces of the generic types specified shall be prepared and painted according to their status, intended function and location, using the painting system for that surface, function and location as specified, unless specifically identified on the Drawings as a surface not to receive specified painting system.
   a. All new and specifically identified existing surfaces and items except where the natural finish of the material is specified as a corrosion-resistant material not requiring paint; or is specifically shown on the Drawings as indicated by written note, or specified as a surface not to be painted. Where items or surfaces are not specifically mentioned, paint them the same as adjacent similar materials or areas, unless otherwise directed by ENGINEER.
   b. Heating, ventilating, and air conditioning items to be painted include, but are not limited to, the following:
      1) Piping, pipe insulation, pipe hangers, and supports.
      2) Heat exchangers.
      3) Tanks.
      4) Ductwork and insulation.
      5) Motors, mechanical equipment, and supports.
      6) Accessory items.
   c. Surface preparation and painting of all new and specifically identified existing items, both interior and exterior, and other surfaces, including items furnished by OWNER, are included in the Work, except as otherwise shown on the Drawings or specified.
   d. Removal of all substances, top coats, primers and all intermediate coats of paint and other protective or decorative toppings on those items and surfaces to remain that are identified to receive a painting system under
this Section, in order to provide surfaces acceptable for application of painting system specified.

e. Approved stepped-down mock-ups for all painting systems showing all components of the surface preparation and paint system application before the start of any Work. Check all dry film thicknesses; demonstrate methods of surface preparation and methods of application in addition to obtaining ENGINEER’S approval of colors and textures to be used in the Work.

3. Types of products required include the following:
   a. Amine catalyzed epoxies.
   b. Polyamine and polyamidoamine catalyzed epoxies.
   c. Fiberglass fiber reinforced polyamine and polyamidoamine catalyzed epoxies.
   d. Cycloaliphatic amine catalyzed epoxies.
   e. Homopolymer organic/inorganic oxirane capped thermosetting resins.
   f. Polyamide catalyzed epoxies.
   g. Waterborne, cementitious acrylics.
   h. Waterborne, styrenated acrylates.
   i. Aliphatic acrylic polyurethanes.
   j. Inorganic, zinc-rich ethyl silicates.
   k. Heat-resistant silicones.
   l. Waterborne, vinyl and latex acrylics.
   m. Auxiliary materials and accessories.

4. Pipe markers, as specified.

B. Coordination:
1. Review installation, schedules, removal and demolition procedures under other Sections and coordinate them with the Work specified herein.
2. Coordinate the painting of areas that will become inaccessible once equipment, laboratory furniture, lockers and similar fixed items have been installed.
3. Coordinate primers with finish paint materials in order to provide primers that are compatible with finish paint materials used. Review other Sections and other contracts where primed surfaces are provided, to ensure compatibility of the total painting system for the various surfaces. Responsibility for coordinating the compatibility of all shop-primed and field-painted items in other Sections belongs to CONTRACTOR.
4. Furnish information to ENGINEER on the characteristics of the finish materials proposed for use, to ensure that compatible prime coats are used. Provide barrier coats over incompatible primers or remove and repaint as required. Notify ENGINEER, in writing, of anticipated problems using the specified painting systems with surfaces primed by others. Reprime all equipment primed in the factory and other factory-primed items that are damaged or scratched.
5. All shop primed items shall be re-blasted in the field and re-primed prior to being finish coated. No equipment that has been shop primed and finish coated shall be field painted, unless it has been re-blasted, re-primed and finish coated in the field.

D. Work Not Included: The following categories of Work are not included as part of the painting Work, or are included in other Sections:

1. Shop-Priming: Shop-priming of structural metal, miscellaneous metal fabrications, other metal items and fabricated components such as shop-fabricated or factory-built heating and ventilating and electrical equipment or accessories shall conform to applicable requirements of this Section but are included under other Sections.

2. Pre-finished Items:
   a. Items furnished with such finishes as baked-on enamel, porcelain and polyvinylidene fluoride shall only be touched up at the site by CONTRACTOR using manufacturer's recommended compatible field-applied touchup paint.
   b. Items furnished with such finishes as chrome plating or anodizing.

3. Concealed Surfaces: Nonmetallic wall or ceiling surfaces in areas not exposed-to-view, and generally inaccessible areas, such as furred spaces, pipe chases and duct and elevator shafts.

4. Concrete surfaces below elevation (--1--), unless otherwise shown on the Drawings or specified.

5. Concrete floors.

6. Face brick, glazed structural tile and prefaced, ground-faced or split-faced concrete masonry units.

7. Exterior face of architectural precast concrete.

8. Collector bearings, shafts and chains, wood flights, wood stop logs and wood baffles.

9. Corrosion-Resistant Metal Surfaces: Where the natural oxide of the item forms a barrier to corrosion, whether factory- or site-formed, including such materials as copper, bronze, muntz metal, zinc, terne metal and stainless steel.

10. Operating Parts and Labels:
   a. Do not paint moving parts of operating units, mechanical and electrical parts such as valve and damper operators, linkages, sensing devices, interior of motors and fan shafts.
   b. Do not paint over labels required by governing authorities having jurisdiction, or any equipment identification, performance rating, name or nomenclature plates.
   c. Cover moving parts and labels during the painting Work with protective masking. Remove all protective masking upon completion of Work. Remove all paint, coatings or splatter which comes in contact with such labels.
11. Structural and miscellaneous metals covered with concrete shall only receive a primer compatible with the covering material.

12. Existing structures, equipment and other existing surfaces and items, unless otherwise shown on the Drawings or specified.

D. Definitions: Specific coating terminology used in this Section shall be in accordance with the definitions in ASTM D 16, ASTM D 3960 and the following definitions:

1. The term "paint" includes pretreatment and all painting system materials, such as primer, emulsion, enamel, organic/inorganic polymer coating, stain sealer and filler, and other applied materials whether used as prime, filler, intermediate or finish coats.

2. The term "exposed" means all items not covered with cement plaster, concrete or fireproofing. Items covered with these materials shall be provided with specified primer only, except where specified as a surface not to be painted. Exposed-to-view surfaces also include those areas visible after permanent or built-in fixtures, convector covers, ceiling tile, covers for finned tube radiation, grilles, etc. are in-place, in areas scheduled to be painted.

3. Dry Film Thickness (DFT): The thickness of one fully cured continuous application of coating.

4. Field Coat: The application or the completion of application of the coating system after installation of the surface at the site of the Work.

5. Shop Coat: One or more coats applied in a shop or plant prior to shipment to the site of erection or fabrication, where the field or finishing coat is applied.

6. Barrier Coat: An intermediate coat used to bond different types of paint coats. Coatings used to improve the adhesion of a succeeding coat.

7. Photochemically Reactive Organic Material: Any organic material that will react with oxygen, excited oxygen, ozone or other free radicals generated by the action of sunlight on components in the atmosphere giving rise to secondary contaminants and reaction intermediates in the atmosphere which can have detrimental effects.

8. Volatile Organic Compound (VOC) Content: The portion of the coating that is a compound of carbon, is photochemically reactive, and evaporates during drying or curing, expressed in grams per liter or pounds per gallon.

9. Touch-Up Painting: The application of a paint on areas of painted surfaces to repair marks, scratches, and areas where the coating has deteriorated to restore the coating film to an unbroken condition.

E. Description of Colors and Finishes:

1. Color Selection:
   a. A maximum of 10 different colors shall be selected by ENGINEER, in addition to color-coding of all pipelines, valves, equipment and ducts.
   b. ENGINEER reserves the right to select all non-standard colors for all paint systems specified within the ability of manufacturer to produce
such non-standard colors. CONTRACTOR shall supply such colors, at no additional cost to OWNER.

2. Color Coding of Pipelines, Valves, Equipment and Ducts:
   a. In general, all color-coding of pipelines, valves, equipment and ducts shall comply with applicable standards of ANSI A13.1, ANSI Z535.1 and CFR 1910.144. Provide color-coding for pipelines included in Paragraph 1.1.F.3.b, Pipeline Color Table, for specified pipelines.
   b. For equipment located on roofs or where exposed-to-view such as on exterior building facades, or in offices or lobbies, the color shall be selected by ENGINEER.

3. Color Coding of Pipelines and Equipment:
   a. Finish coats of paint for pipelines and equipment shall be coded in basic colors. Colors shall be brilliant, distinctive shades matching the following safety colors in accordance with ANSI Z535.1 color specifications for safety colors and other primary colors:

<table>
<thead>
<tr>
<th>Color</th>
<th>Designation*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>Safety Black; IN06</td>
</tr>
<tr>
<td>Blue</td>
<td>Safety Blue; SC06</td>
</tr>
<tr>
<td>Brown</td>
<td>&quot;Chipmunk&quot;; YB23</td>
</tr>
<tr>
<td>Charcoal</td>
<td>&quot;Graphite&quot;; GR32</td>
</tr>
<tr>
<td>Gray</td>
<td>&quot;Gray-ANSI 61&quot;; IN05</td>
</tr>
<tr>
<td>Green</td>
<td>Safety Green; SC07</td>
</tr>
<tr>
<td>Light Gray</td>
<td>&quot;Battleship Gray&quot;; GR13</td>
</tr>
</tbody>
</table>

   b. General Color Code: Unless otherwise specified, the following color code shall be used:

<table>
<thead>
<tr>
<th>Color</th>
<th>Designation*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light Green</td>
<td>&quot;Misty Jade&quot;; GB38</td>
</tr>
<tr>
<td>Orange</td>
<td>Safety Orange; SC03</td>
</tr>
<tr>
<td>Red</td>
<td>Safety Red; SC09</td>
</tr>
<tr>
<td>White</td>
<td>Safety White; WH0</td>
</tr>
<tr>
<td>Yellow</td>
<td>Safety Yellow; SC01</td>
</tr>
</tbody>
</table>

*Color designations are provided as Tnemec Company, Incorporated paint color numbers and are provided as a standard of quality; equivalent colors matching these colors will be acceptable to ENGINEER. Provide ENGINEER with direct color comparisons of color numbers available from manufacturer submitted at time of Shop Drawing submission.

b. General Color Code: Unless otherwise specified, the following color code shall be used:
# Piping and Sign Color Code

<table>
<thead>
<tr>
<th>Piping and Legend</th>
<th>Piping Color</th>
<th>Lettering Color</th>
<th>Background Color</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Water</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spray Water</td>
<td>Red</td>
<td>Black</td>
<td>Red</td>
</tr>
<tr>
<td>Potable Water</td>
<td>Lt. Blue/White Bands</td>
<td>Black</td>
<td>Blue</td>
</tr>
<tr>
<td>Seal Water</td>
<td>Red</td>
<td>White</td>
<td>Red</td>
</tr>
<tr>
<td>Chilled Water Return</td>
<td>Blue</td>
<td>White</td>
<td>Green</td>
</tr>
<tr>
<td>Chilled Water Supply</td>
<td>Blue</td>
<td>White</td>
<td>Green</td>
</tr>
<tr>
<td>Cold Water</td>
<td>Blue</td>
<td>White</td>
<td>Green</td>
</tr>
<tr>
<td>Hot Water Return</td>
<td>Blue/Red Bands</td>
<td>Black</td>
<td>Yellow</td>
</tr>
<tr>
<td>Hot Water Supply</td>
<td>Blue/Red Bands</td>
<td>Black</td>
<td>Yellow</td>
</tr>
<tr>
<td>Non-Potable Water</td>
<td>Red/Black Bands</td>
<td>White</td>
<td>Red</td>
</tr>
<tr>
<td>(Reuse Water)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| **Air and Gas**   |              |                 |                  |
| Process Air       | White        | Black           | White            |
| Chlorine Gas      | Yellow/Green Bands | White | Yellow |
| Natural Gas       | Red          | Black           | Yellow           |
| Digester Gas, H.P | Red          | Black           | Yellow           |
| Digester Gas, L.P.| Red          | Black           | Yellow           |
| High Pressure Air | White/Red Bands | Black | White |

| **Chemicals**     |              |                 |                  |
| Ferric Chloride   | Safety Orange | Black           | Safety Orange    |
| Chlorine Solution | Yellow       | Black           | Yellow           |
| Liquid Polymer    | Yellow       | Black           | Yellow           |
| Polymer Feed      | Yellow       | Black           | Yellow           |
| Methanol          | Yellow       | Black           | Yellow           |
| Sodium Hydroxide  | Yellow       | Black           | Yellow           |
| Sodium Hypochlorite | Yellow   | Black           | Yellow           |
| Hydrochloric Acid | Yellow       | Black           | Yellow           |

91st Avenue WWTP Sludge
Solar Drying Beds 09900-6 03/30/12
### PROCESS

<table>
<thead>
<tr>
<th>Description</th>
<th>Piping Color</th>
<th>Lettering Color</th>
<th>Background Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Effluent</td>
<td>Brown</td>
<td>Black</td>
<td>Green</td>
</tr>
<tr>
<td>Digester Tank Drains</td>
<td>Brown</td>
<td>Black</td>
<td>Green</td>
</tr>
<tr>
<td>Floor Drains</td>
<td>Gray</td>
<td>Black</td>
<td>Green</td>
</tr>
<tr>
<td>Settling Tank Drains</td>
<td>Gray</td>
<td>Black</td>
<td>Green</td>
</tr>
<tr>
<td>Storage Tank Drains</td>
<td>Gray</td>
<td>Black</td>
<td>Green</td>
</tr>
<tr>
<td>Storm Drains</td>
<td>Gray</td>
<td>Black</td>
<td>Green</td>
</tr>
<tr>
<td>Sump Drains</td>
<td>Gray</td>
<td>Black</td>
<td>Green</td>
</tr>
<tr>
<td>Mixed Liquor</td>
<td>Brown</td>
<td>Black</td>
<td>Green</td>
</tr>
<tr>
<td>Scum</td>
<td>Black</td>
<td>Black</td>
<td>Green</td>
</tr>
<tr>
<td>Sewage</td>
<td>D. Gray</td>
<td>Black</td>
<td>Green</td>
</tr>
<tr>
<td>Sewage Sampling Lines</td>
<td>D. Gray</td>
<td>Black</td>
<td>Green</td>
</tr>
<tr>
<td>Sludge</td>
<td>Brown</td>
<td>Black</td>
<td>Green</td>
</tr>
<tr>
<td>Digested Sludge</td>
<td>Brown</td>
<td>Black</td>
<td>Green</td>
</tr>
<tr>
<td>Primary Sludge</td>
<td>Brown</td>
<td>Black</td>
<td>Green</td>
</tr>
<tr>
<td>Raw Sludge</td>
<td>Brown</td>
<td>Black</td>
<td>Green</td>
</tr>
<tr>
<td>Recirculated Digester Sludge</td>
<td>Brown</td>
<td>Black</td>
<td>Green</td>
</tr>
<tr>
<td>Return Activated Sludge</td>
<td>Brown</td>
<td>Black</td>
<td>Green</td>
</tr>
<tr>
<td>Waste Activated Sludge</td>
<td>Brown</td>
<td>Black</td>
<td>Green</td>
</tr>
<tr>
<td>Supernatant</td>
<td>Black</td>
<td>Black</td>
<td>Green</td>
</tr>
<tr>
<td>Digester Tank Overflow</td>
<td>Brown</td>
<td>Black</td>
<td>Green</td>
</tr>
<tr>
<td>Storage Tank Overflow</td>
<td>Brown</td>
<td>Black</td>
<td>Green</td>
</tr>
<tr>
<td>Grit Lines</td>
<td>Brown</td>
<td>Black</td>
<td>Yellow</td>
</tr>
<tr>
<td>Grit Overflow</td>
<td>Brown</td>
<td>Black</td>
<td>Yellow</td>
</tr>
<tr>
<td>Grit Dewatering</td>
<td>Brown</td>
<td>Black</td>
<td>Yellow</td>
</tr>
<tr>
<td>Centrate Lines</td>
<td>Gray</td>
<td>Black</td>
<td>Yellow</td>
</tr>
<tr>
<td>Sludge Cake Lines</td>
<td>Brown</td>
<td>White</td>
<td>Green</td>
</tr>
<tr>
<td>Scrubber Blowdown</td>
<td>Yellow</td>
<td>Black</td>
<td>Yellow</td>
</tr>
</tbody>
</table>

### PIPING AND LEGEND

<table>
<thead>
<tr>
<th>Piping Color</th>
<th>Lettering Color</th>
<th>Background Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown</td>
<td>White</td>
<td>Brown</td>
</tr>
<tr>
<td>Brown</td>
<td>White</td>
<td>Brown</td>
</tr>
<tr>
<td>Gray</td>
<td>Black</td>
<td>Green</td>
</tr>
<tr>
<td>Yellow</td>
<td>Black</td>
<td>Yellow</td>
</tr>
</tbody>
</table>

### OTHER

<table>
<thead>
<tr>
<th>Description</th>
<th>Piping Color</th>
<th>Lettering Color</th>
<th>Background Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lube Oil</td>
<td>Brown</td>
<td>White</td>
<td>Brown</td>
</tr>
<tr>
<td>Waste Oil</td>
<td>Brown</td>
<td>White</td>
<td>Brown</td>
</tr>
<tr>
<td>Roof Drains</td>
<td>Gray</td>
<td>Black</td>
<td>Green</td>
</tr>
<tr>
<td>Methanol Solution</td>
<td>Yellow</td>
<td>Black</td>
<td>Yellow</td>
</tr>
</tbody>
</table>
### PROCESS CHEMICAL SOLUTIONS

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Color</th>
<th>Lettering</th>
<th>Background</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alum</td>
<td>Medium Green</td>
<td>Black</td>
<td>None</td>
</tr>
<tr>
<td>Ferric Chloride</td>
<td>Orange</td>
<td>White</td>
<td>Black</td>
</tr>
<tr>
<td>Polymeric Coagulant</td>
<td>Lt. Green</td>
<td>Green</td>
<td>Lt. Blue</td>
</tr>
<tr>
<td>Polymeric Filter Aid</td>
<td>Lt. Green</td>
<td>White</td>
<td>Dk. Blue</td>
</tr>
<tr>
<td>Polymeric Thickener</td>
<td>Lt. Green</td>
<td>White</td>
<td>Dk. Blue</td>
</tr>
<tr>
<td>Polymeric Centrifuge</td>
<td>Lt. Green</td>
<td>White</td>
<td>Dk. Blue</td>
</tr>
<tr>
<td>Polyphosphate</td>
<td>Medium Green</td>
<td>Black</td>
<td>None</td>
</tr>
<tr>
<td>Carbon</td>
<td>Black</td>
<td>White</td>
<td>None</td>
</tr>
<tr>
<td>Sulfuric Acid</td>
<td>Yellow</td>
<td>Black</td>
<td>Red</td>
</tr>
<tr>
<td>Caustic Soda</td>
<td>Dk. Green</td>
<td>White</td>
<td>None</td>
</tr>
<tr>
<td>Lime</td>
<td>Medium Green</td>
<td>Black</td>
<td>None</td>
</tr>
<tr>
<td>Fluoride</td>
<td>Yellow</td>
<td>Black</td>
<td>Lt. Blue</td>
</tr>
<tr>
<td>Copper Sulfate</td>
<td>Medium Green</td>
<td>Black</td>
<td>Blue</td>
</tr>
</tbody>
</table>

### DISINFECTANTS

<table>
<thead>
<tr>
<th>Disinfectant</th>
<th>Color</th>
<th>Lettering</th>
<th>Background</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorine - Gas</td>
<td>Yellow</td>
<td>Black</td>
<td>Green</td>
</tr>
<tr>
<td>Chlorine - Liquid</td>
<td>Yellow</td>
<td>Black</td>
<td>None</td>
</tr>
<tr>
<td>Chlorine - Solution</td>
<td>Yellow</td>
<td>Black</td>
<td>None</td>
</tr>
</tbody>
</table>

### PLANT AIR

<table>
<thead>
<tr>
<th>Air Type</th>
<th>Color</th>
<th>Lettering</th>
<th>Background</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant Air Piping</td>
<td>White</td>
<td>Black</td>
<td>None</td>
</tr>
<tr>
<td>High Pressure Air Piping</td>
<td>White</td>
<td>Black</td>
<td>Red</td>
</tr>
</tbody>
</table>

### WATER LINES

<table>
<thead>
<tr>
<th>Water Type</th>
<th>Color</th>
<th>Lettering</th>
<th>Background</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water - Potable</td>
<td>Lt. Blue</td>
<td>Black</td>
<td>None</td>
</tr>
<tr>
<td>Water - Potable (HOT)</td>
<td>Lt. Blue</td>
<td>Black</td>
<td>Red</td>
</tr>
<tr>
<td>Water - Deionized</td>
<td>Lt. Blue</td>
<td>Black</td>
<td>None</td>
</tr>
<tr>
<td>Water - Raw</td>
<td>Dk. Green</td>
<td>Black</td>
<td>Lt. Gray</td>
</tr>
<tr>
<td>Water - Non Potable (Plant Water)</td>
<td>Lt. Blue</td>
<td>Black</td>
<td>Purple</td>
</tr>
<tr>
<td>Water - Non Potable (Reuse)</td>
<td>Purple</td>
<td>Black</td>
<td>None</td>
</tr>
</tbody>
</table>

### WASTE WATER

91st Avenue WWTP Sludge
Solar Drying Beds
09900-8
03/30/12
### Domestic Wastewater
- Color: Gray
- Secondary Color: Black
- Third Color: None

### Process Wastewater
- Color: Gray
- Secondary Color: Black
- Third Color: Lt. Blue

### FIRE QUENCHING MATERIALS
- Water, Foam, CO2, Halon, Fire Hydrants, including sections of potable water for Fire Dept. access (no label)
  - Color: Red
  - Secondary Color: None
  - Third Color: None

### SAMPLE LINE PIPING
- Raw Water Sample Lines: Dk. Blue, White, Black
- Non Raw Water Sample Lines: Dk. Blue, Black, Lt. Blue

### USED WATER RECOVERY FACILITIES
- Floor Drains: Gray, Black, Green
- Settling Tank Drains: Gray, Black, Green
- Storage Tank Drains: Gray, Black, Green
- Sump Drains: Gray, Black, Green
- Scum: Brown, Black, Green
- Sludge: Brown, Black, Green
- Storage Tank Overflow: Brown, Black, Green

### OTHER
- Natural Gas: Orange, Black, Lt. Blue
- Lube Oil: Brown, White, Brown
- Waste Oil: Brown, White, Brown
- Roof Drains: Gray, Black, Green

---

c. The color of the final coats shall match as closely as possible, without custom blending, the color tabulated under the specific pipeline service.

4. After approval by ENGINEER of colors and Shop Drawing submittals and prior to beginning painting Work, ENGINEER will furnish color schedules for surfaces to be painted listed in Article 2.1, below.

F. Abbreviations and Symbols:
1. Abbreviations and symbols used in Tables are explained in Article 2.2, below, and provide information on generic composition of the required materials, manufacturers, number of coats and their dry mil film thickness per coat (DMFTPC) and coverage for calculating the required number of gallons for the Work.
1.2 QUALITY ASSURANCE

A. Applicator Qualifications:
1. Engage a single applicator regularly performing installation of paint materials, with documented skill and successful experience in the installation of the types of materials required and who agrees to employ only tradesmen who are trained, skilled and have successful experience in installing the types of materials specified.
2. Painting subcontractors whose submissions indicate that they have not had the experience required to perform the Work shall not be approved. Qualifying experience shall include at least three previous projects of similar magnitude and complexity to this project that have been completed not less than 18 months prior to submission of qualifications to ENGINEER.
3. Submit name and qualifications to ENGINEER along with the following information on a minimum of three successful projects:
   a. Names and telephone numbers of owners, architects or engineers responsible for projects.
   b. Approximate contract cost of the paint materials.
   c. Amount of area installed.
4. Submit proof of acceptability of applicator by manufacturer to ENGINEER.

B. Source Quality Control:
1. Obtain materials only from manufacturers who will provide the services of a qualified manufacturer's representative at the site at the commencement of painting Work to advise on materials, mock-ups, installation and finishing techniques, at the completion of the Work to advise ENGINEER on the acceptability of completed Work, and during the course of the Work as may be requested by ENGINEER.
2. Certify long-term compatibility of all coatings with surfaces.
3. Do not submit products that decrease the number of coats, the surface preparation, or the generic type and formulation of coating(s) specified. Products exceeding VOC limits specified will not be approved.
4. ENGINEER may review manufacturer’s recommendations concerning methods of installation and number of coats of paint for each painting system. CONTRACTOR prepare construction cost estimates based on painting systems, number of coats, coveragers and installation methods specified.
5. All proposed "or equal" products shall be submitted with direct comparison to products specified including information on durability, adhesion, color and gloss retention, percent solids, VOC's per gallon and recoatability after curing.
6. "Or equal" manufacturers shall furnish the same color selection as the manufacturers specified, including intense chroma and custom pigmented colors in all painting systems.

7. Color Pigments: Provide pure, nonfading, applicable types to suit the surfaces and services indicated. Comply with the following:
   a. Lead and Chromate: Lead and chromate content shall not exceed amount permitted by governing authorities having jurisdiction.
   b. Areas subject to hydrogen sulfide fume exposure shall be identified by ENGINEER. Manufacturer shall notify ENGINEER of colors that are not suitable for long-term color retention in such areas.
   c. Comply with manufacturer’s recommendations on preventing coating contact with levels of carbon dioxide and carbon monoxide that may cause yellowing during application and initial stages of curing of paint coatings.

8. Obtain each product from only one manufacturer. Multiple manufacturing sources for the same system component will not be approved by ENGINEER.

9. Certify product shelf life history for each product source for materials manufactured by the same manufacturer, but purchased and stored at different locations or obtained from different sources.

10. Constantly store materials to be used in the painting Work between 60°F and 90°F, and in accordance with the manufacturer’s approved written recommendations, for not more than six months. Certify to ENGINEER that painting materials have been manufactured within six months of installation and have not, nor will be, subjected to freezing temperatures.

11. Provide the services of a qualified manufacturer's representative at the Project site for a minimum of one trip and one 8 hour work days at the commencement of Work to advise on materials, installation and finishing techniques.

12. Certify long term compatibility of all coatings with all substrates.

13. Provide the services of a qualified manufacturer's representative at the Project site for a minimum of one trips and one 8 hour work days at completion of the Work to inspect the Work. Within seven calendar days after inspection by the manufacturer, provide a written report from the manufacturer certifying the coatings have been applied properly and in accordance with the manufacturer's recommendations and requirements. Deficiencies in the coatings system, if any, noted by the manufacturer during final inspection shall be defined in the manufacturer's report including corrective measures to be implemented by CONTRACTOR at CONTRACTOR'S expense. Following corrective measures by CONTRACTOR, manufacturer shall re-inspect the Work, at CONTRACTOR'S expense and within seven days after re-inspection, provide a written report from the manufacturer certifying the coatings have been applied properly and in accordance with the manufacturer's recommendations and requirements.
C. Testing Agency Qualifications: To qualify for approval, an independent testing agency shall demonstrate to ENGINEER’S satisfaction, based on evaluation of criteria submitted by testing agency, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work in accordance with ASTM E 329.

D. Stepped-Down Mock-Ups:
1. Demonstrate installation of specified painting system(s) on actual wall surfaces and building components at locations selected by ENGINEER.
2. Provide 4 foot - 0 inch by 8 foot - 0 inch long stepped-down sample area for each painting system. Prior to the application of a painting system, but after ENGINEER’S approval of the components of each painting system, apply a 4 foot-0 inch wide sample of each operation and application step required by this Section and the specified manufacturer's written application recommendations. Each application step shall be shown as a 2 foot - 0 inch long section that shall remain exposed in order to demonstrate the Work performed by that step. Continue application procedures until topcoat is provided. Topcoat shall be a minimum of 2 foot - 0 inches long. Finished mock-up for each paint system, when completed, shall reveal each step and each coat of paint required for the paint system with 2 foot - 0 inch wide strips revealing Work performed to prepare the surface and apply each coat. Lengthen overall mock-up as may be required in order to completely demonstrate each painting system. Use tinted shades differing from coat to coat for each component of each painting system.
3. ENGINEER may approve or disapprove each component of each painting system on an individual component basis.
4. Painting system Work that does not meet the standard approved on the sample areas shall be removed and replaced with new material.
5. Painting system Work advanced without approved mock-ups shall be stopped, and mock-ups prepared for approval by ENGINEER.

E. Requirements of Regulatory Agencies: Surface preparation and application of coatings shall be performed by CONTRACTOR in compliance with all applicable federal, state and local occupational safety and health regulations and Maricopa County Air Pollution Control Regulations. Obtain and comply with all safety precautions recommended by the paint manufacturer in printed instructions or special bulletins and as required by applicable regulations. Provide forced ventilation in all areas where inadequate ventilation exists.
1. Painting systems for surfaces in contact with potable water, or water being treated for potable use, shall be NSF approved and shall not impart any taste or odor to the water or result in any organic or inorganic content in excess of the maximum allowable contaminant level established by governing authorities having jurisdiction. All such painting systems shall be approved by the applicable regulatory agency. CONTRACTOR revise painting
systems specified herein to provide manufacturer's regulatory agency approved painting system(s) where required.

2. Comply with the regulations of governing authorities having jurisdiction for air quality and material disposal regulations. Revise painting systems specified herein in order to provide manufacturer's regulatory agency approved painting systems, where required.

3. Comply with governing authorities having jurisdiction for blast cleaning operations, confined space entry and disposition of spent abrasive and debris.

F. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified.

2. ASTM D 2200, (SSPC-Vis 1), Pictorial Surface Preparation Standards for Painting Steel Surfaces.
5. ASTM D 4258, Practice for Surface Cleaning Concrete for Coating.
6. ASTM D 4259, Practice for Abrading Concrete.
7. ASTM D 4263, Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
8. ASTM D 4285, Test Method for Indicating Oil or Water in Compressed Air.
9. ASTM D 4417, Test Method for Field Measurement of Surface Profile of Blast Cleaned Steel.
17. Steel Structures Painting Council, SSPC - PA2, Measurement of Dry Coating Thickness with Magnetic Gages.
18. Steel Structures Painting Council, SSPC - VIS 1, Visual Standard for Abrasive Blast Cleaned Steel.
G. Pre-Painting Meeting:

1. Prior to the installation of painting systems, arrange a meeting at the job-site with painting applicator and its foreman, the paint manufacturer's technical representative, the installers of other work in and around the painting system Work that must follow the painting Work, ENGINEER and other representatives directly concerned with performance of the painting Work. Record the discussions of the conference and the decisions and agreements (or disagreements) and furnish a copy of the record to each party attending. Review foreseeable methods and procedures relating to the painting Work, including but not necessarily limited to, the following:
   a. Review Project requirements, including Contract Documents, Project Schedule, approved Shop Drawings, pending and approved Change Orders and requests for information that may have been submitted by CONTRACTOR to ENGINEER.
   b. Review required samples and submittals, both completed and yet to be completed.
   c. Review status of surfaces including drying, surface preparations and similar considerations.
   d. Review availability of materials, tradesman, equipment and facilities needed to make progress, avoid delays and protect the Work from damaging conditions.
   e. Review required inspection, testing, certifying and quality control procedures.
   f. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions. Supplemental heating sources, as may be required to continue the Work under low temperature conditions, shall be in operating order and acceptable to paint applicator.
   g. Review methods for complying with regulations of governing authorities having jurisdiction, such as compliance with environmental protection, health, safety, fire and similar regulations.

2. Reconvene the meeting at the earliest opportunity if additional information must be developed in order to conclude the subjects under consideration.

3. Record any revisions or changes agreed upon, reasons therefore, and parties agreeing or disagreeing with them.

H. Maintain a Paint Application Log containing the information as shown on the log attached at the end of this Section. The Paint Application Log shall be maintained on a daily basis for all areas where the Work is being performed. The Paint Application Log shall be turned over to the ENGINEER by 9:00 a.m. the following day that the work was performed. The log shall include the following:

1. Date.
2. Time.
3. Weather condition (at work location).
4. Air temperature (at work location).
5. Surface temperature (at work location).
6. Dew point (at work location).
7. Humidity (at work location).
8. Location/area square footage.
9. Description of Work performed.
10. Materials used, colors and batch numbers, quantity of materials used (not including waste).
11. Application/surface preparation equipment and personnel.
12. WFT/surface profile measurements.
13. Comments, quality control procedures.

1.3 SUBMITTALS

A. Samples: Submit for approval the following:
   1. Copies of manufacturer's complete color charts for each coating system.

B. Shop Drawings: Submit for approval the following:
   1. Copies of manufacturer's technical information and test performance data, including paint analysis, VOC content in comparison to maximum allowed by Specifications, and application instructions for each material proposed for use.
   2. Submit Applicator's Qualifications in accordance with Paragraph 1.2.A., above.
   3. Submit proof of acceptability of proposed application techniques by the paint manufacturer selected.
   4. Copies of CONTRACTOR'S proposed protection procedures in each area of Work explaining methods of protecting adjacent surfaces from splatter, for confining application procedures in a manner that allows other work adjacent to surface preparation and painting Work to proceed safely and without interruption, and for maintaining acceptable application, curing and environmental conditions during and after painting system(s) application.
   5. List each material and cross-reference to the specific painting system and application. Identify by manufacturer's catalog number and general classification. State number of gallons of each product being purchased for delivery to the site and the square foot area calculated to be covered by each painting system specified based on theoretical loss of 20 percent. Where actual area to be covered by any paint system exceeds the area submitted to ENGINEER for that system, proof of additional material purchase shall be submitted to ENGINEER. Calculated coverage shall be as specified for each component of each painting system specified. This requirement shall not take precedence over CONTRACTOR'S responsibility to provide dry film thickness required for each component of each painting system.
   6. Identify maximum exposure times and temperatures allowable for each paint system component before the next coat of paint must be applied. Submit
CITY OF PHOENIX: Water Services Department
PROJECT NAME: 91st Avenue WWTP Sludge Solar Drying Beds
PROJECT NUMBER: WS90100098

proposed methods for preparing surfaces for subsequent coats if maximum exposure times are exceeded.

7. Information on curing times and environmental conditions that affect the curing time of each system component and proposed methods for accommodating variations in curing time. Identify this information for each painting system used in the Work.

8. Specification for spray equipment with cross-reference to paint manufacturer's recommended equipment requirements.

9. Maintenance Manual: Upon completion of the painting Work, furnish ENGINEER copies of detailed maintenance manual including the following information:
   a. Complete and updated product catalog of paint manufacturer’s currently available products including complete technical information on each product. Identify product names and numbers of each product used in the painting Work.
   b. Name, address and telephone number of manufacturer, local distributor, applicator and technical representative.
   c. Detailed procedures for routine maintenance and cleaning.
   d. Detailed procedures for light repairs such as dents, scratches and staining.

C. Certificates: Submit for approval the following:
   1. Certificate stating that materials meet or exceed Specification requirements.
   2. Evidence of shelf life history for all products verifying compliance with the requirements of this Section.
   3. Provide notarized statement verifying that all painting systems are compatible with surfaces specified. All painting systems' components have been reviewed by an authorized technical representative of the paint manufacturer for use as a compatible system. Verify that all painting systems are acceptable for the exposures specified and that the manufacturer is in agreement that the selected systems are proper, compatible and are not in conflict with the paint manufacturer's recommended specifications. Show by copy of transmittal form that a copy of the letter has been transmitted to the paint applicator.
   4. Certificate conforming to the requirements of Paragraph 1.2.B., above.

D. Statement of Application: Upon completion of the painting Work, submit a notarized statement to ENGINEER signed by CONTRACTOR and painting applicator stating that the Work complies with the requirements of these Specifications and that application methods, equipment and environmental conditions were proper and adequate for the conditions of installation and use.

E. Test Reports: Submit for approval the following:
   1. Certified laboratory test reports for required performance and analysis testing in compliance with ASTM E 329.

91st Avenue WWTP Sludge Solar Drying Beds 09900-16 03/30/12
2. Results of adhesion testing on existing surfaces containing paints or other coatings to be top coated with paint systems specified. Prior to adhesion testing, submit a testing plan establishing methods, procedures and number of tests in each area where existing coatings are shown to remain and become the substrate for painting systems specified herein. Based on results of adhesion testing, recommend methods, procedures and painting system modifications, if necessary, for proceeding with the Work.

3. Results in accordance with Article 3.5, below.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials: Deliver all materials to the site in original, new and unopened packages and containers, accurately and legibly labeled with manufacturer's name and with label accurately describing container contents; and with the following information:
   1. Name and generic description of material.
   2. Manufacturer's stock number and date of manufacture.
   3. Manufacturer's name.
   4. Contents by volume, for major pigment and vehicle constituents.
   5. Pounds per gallon of volatile organic compounds.
   6. Thinning instructions, where recommended.
   7. Application instructions.
   8. Color name and number.

B. Storage of Materials:
   1. Store only acceptable materials at the site.
   2. Store in an environmentally controlled location as recommended by paint manufacturer's approved written product information guidelines. Keep area clean and accessible. Remove materials from the site that have exceeded the recommended manufacturer's storage life.
   3. Store materials not in actual use, in tightly covered containers.
   4. Comply with health and fire regulations of governing authorities having jurisdiction.

C. Handling of Materials:
   1. Handle materials in a manner, which precludes the possibility of contamination, or incorrect product catalyzation.
   2. Do not open containers or mix components until necessary preparatory Work has been completed and approved by ENGINEER and painting Work will start immediately.
   3. Maintain containers used in storage, mixing, and application of paint in a clean condition, free of foreign materials and residue.

1.5 PROJECT CONDITIONS
A. Site Facilities:
   1. Supplemental heat sources, as may be required to maintain both ambient and surface temperatures within the range recommended by the manufacturer for paint system applications, are not available at the site.
   2. The provision of all supplemental heat energy sources, power, equipment and operating, maintenance and temperature monitoring personnel is the responsibility of CONTRACTOR.
   3. Do not use heat sources, which emit carbon dioxide or carbon monoxide into areas being painted. Properly locate and vent all such heat sources to the exterior such that paint systems are unaffected by exhaust products.

B. Existing Conditions:
   1. Existing materials specified to be painted as part of the Work shall have their surfaces prepared to meet the requirements of the painting systems specified. Where existing paint systems will provide the substrate for painting systems specified, provide adhesion testing on existing surfaces to be painted. Abrasive blasting, scraping or other abrading or surface film removal, or preparatory techniques as approved by ENGINEER shall be provided as part of the Work.
   2. Before painting is started in any area, all surfaces to be painted and floors shall be cleaned of all dust using commercial vacuum cleaning equipment equipped with high-efficiency particulate air filters (HEPA filters) and dust containment systems.
   3. After painting operations begin in a given area cleaning shall be done only with commercial vacuum cleaning equipment with high-efficiency particulate air filters (HEPA filters) and dust containment systems.

C. Environmental Requirements:
   1. Apply water-base paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 55°F and 90°F, unless otherwise permitted by the paint manufacturer's printed instructions.
   2. Surfaces to be painted shall be at least 5°F above the dew point temperature and shall be dry to the touch. Apply paints only when the temperature of surfaces to be painted, paint material, and the surrounding air temperatures are between 65°F and 95°F, unless otherwise permitted by the paint manufacturer's printed instructions.
   3. Apply paint system within the shortest possible time consistent with manufacturer's approved recommended curing instructions for each coat. If chemical, salt, or other contamination contacts paint film between coats, it shall be removed in accordance with SSPC-SP 1 - Solvent Cleaning, and the surface restored before applying remainder of painting system.
   4. Tanks containing water shall not be painted without specific permission of ENGINEER, and only under conditions where "sweating" of the tank outside surface is not likely to occur within 24 hours of application.
5. Epoxy paints shall not be applied if ambient temperature is expected to go below 50°F within 12 hours of application. Where manufacturer's printed recommendations require a higher minimum ambient temperature, this shall be followed.

6. Do not apply paint in rain, fog or mist; or when the relative humidity exceeds 85 percent; to damp or wet surfaces or when surfaces will reach dew point due to falling or rising temperatures and humidity conditions during the course of the paint application, unless otherwise permitted by the paint manufacturer's printed instructions.

7. Do not paint pipelines and other unacceptably hot or cold surfaces until such surfaces can be maintained within temperature and dew point ranges acceptable to manufacturer. Arrange for such surfaces to be brought within acceptable temperature and dew point ranges as part of the painting Work.

8. Moisture content of surfaces shall be verified to ENGINEER as acceptable to permit the commencement of the painting Work using methods recommended by the specified manufacturer.

9. Painting may be continued during inclement weather only if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified by the paint manufacturer during application and drying periods.

10. Provide adequate illumination and ventilation in all areas where painting operations are in progress.

11. Install piping markers only after all painting and finish work has been completed.

D. Protection:

1. Cover or otherwise protect finished Work of other trades and surfaces not being painted concurrently or not to be painted.

2. During surface preparation and painting, the facility shall remain in operation. Employ procedures that prevent contamination of the process or cause facility shutdown.

3. Coordinate and schedule surface preparation and painting to avoid exposing employees of CONTRACTOR, OWNER, ENGINEER and others not involved with surface preparation and painting. Provide required personnel safety equipment in compliance with the requirements of governing authorities having jurisdiction.

4. Submit protection procedures to be employed by CONTRACTOR to ENGINEER. Do not begin surface preparation and painting Work in any area until ENGINEER approves protection techniques proposed by CONTRACTOR.

5. Provide fire extinguishers and post caution signs warning against smoking and open flame when working with flammable materials.

E. Spent abrasive containing lead and/or chromate paint resulting from the blasting of the "affected surfaces" is classified as a hazardous waste. "Spent abrasive" shall be understood to mean the abrasive generated during the blasting operation,
including the spent water imposed over the abrasive flow, paint residue and any other debris.

F. Care shall be exercised to prevent spent abrasive, water or dust from falling on surrounding buildings, unprotected vegetation, walkways, soils, structures and equipment by covering these areas with non-tearing tarps. Spent abrasive collecting on the ground shall be vacuumed regularly to prevent it from becoming wind blown. The site shall at all times be kept as clean as possible. At the end of the Work day, all spent abrasive shall be thoroughly vacuumed and the site left with a neat appearance.

G. Spent abrasive resulting from the blasting of the "affected surfaces" shall be captured. Non-tearing tarps or plastic sheathing, platforms, partial or total enclosures, temporary barriers or structures, or similar containment methods may be employed for this purpose. These methods must be reviewed by the ENGINEER prior to start of the Work. A detailed procedure describing the proposed blast cleaning operation, abrasive capture and containment techniques, and safety measures to avoid the contamination of the natural environment or surrounding structures.

H. Spent abrasive resulting from the blasting of the "affected surfaces" shall be collected and legally disposed of by CONTRACTOR in a legal and responsible manner. Such disposal shall also be in conformance with all applicable codes, ordinances and regulations for hazardous waste disposal. All other waste, including spent abrasive generated by the blasting of non-affected surfaces, shall be disposed by CONTRACTOR.

I. All reasonable care shall be taken to protect against paint splatter and overspray. Responsibility for any damage incurred to surrounding property resulting from this work belongs to CONTRACTOR.

J. Signs shall be posted, as required, to alert the public of any risks associated with sandblasting debris, painting overspray, etc. All efforts shall be made to prevent debris from becoming wind blown.

K. Responsibility for obtaining any and all permits required to perform the Work belongs to CONTRACTOR.

L. Spent water, resulting from the cleaning operation of "affected surfaces" due to wet sandblasting, may contain hazardous particulates.
PART 2 - PRODUCTS

2.1 PAINTING SYSTEMS

A. New andExisting Concrete Masonry Unit Walls; Non-submerged, Interior:

<table>
<thead>
<tr>
<th>Surface Preparation Paragraph Reference</th>
<th>Generic Components</th>
<th>Manufacturer, Coats, DMFTPC and Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Finish: E.</td>
<td>Finish: 5c.</td>
</tr>
<tr>
<td></td>
<td>Finish: E.</td>
<td>Finish: 5c.</td>
</tr>
</tbody>
</table>

B. New and Existing Exterior Cast-In-Place Concrete, Concrete Masonry Units and Wood; Above-Grade, Exterior:

<table>
<thead>
<tr>
<th>Surface Preparation Paragraph Reference</th>
<th>Generic Components</th>
<th>Manufacturer, Coats, DMFTPC and Coverage</th>
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<tbody>
<tr>
<td>3.2.A., 3.2.B.1., 3.2.B.2., 3.2.B.3., 3.2.B.5., 3.2.B.6., 3.2.B.7., 3.2.B.8., 3.2.I.</td>
<td>Cast-In-Place Concrete and Unit Masonry Primer: J.</td>
<td>Cast-In-Place Concrete and Unit Masonry Primer: 15.</td>
</tr>
<tr>
<td></td>
<td>Wood Primer: S.</td>
<td>Wood Primer: 25.</td>
</tr>
</tbody>
</table>
### C. New and Existing Ferrous Metals, Structural Steel (not protected by sprayed fireproofing), Miscellaneous Ferrous Metals, Exterior Surfaces of Valves, Exterior Surfaces of Ferrous Piping, Aboveground Ductile-Iron Piping and Exterior Surfaces of all Ferrous Piping (both exposed and to be later covered with insulation); Non-submerged, Interior:

<table>
<thead>
<tr>
<th>Surface Preparation Paragraph Reference</th>
<th>Generic Components</th>
<th>Manufacturer, Coats, DMFTEPC and Coverage</th>
</tr>
</thead>
</table>

### D. New and Existing Galvanized Metal, Fiberglass and Non-Ferrous Metal; Non-submerged, Interior:

<table>
<thead>
<tr>
<th>Surface Preparation Paragraph Reference</th>
<th>Generic Components</th>
<th>Manufacturer, Coats, DMFTEPC and Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Finish: $5f$.</td>
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</tbody>
</table>
E. New and Existing Ferrous Metals, Non-Ferrous Metals, Fiberglass and Galvanized Metals; Non-Submerged, Exterior:

**TABLE 5**

<table>
<thead>
<tr>
<th>Surface Preparation Paragraph Reference</th>
<th>Generic Components</th>
<th>Manufacturer, Coats, DMFTPC and Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Galvanized and Non-Ferrous Primer: -</td>
<td>Galvanized and Non-Ferrous Primer: 5f.</td>
</tr>
<tr>
<td></td>
<td>Finish: K.</td>
<td>Finish: 17 or 18.</td>
</tr>
</tbody>
</table>

## 2.2 PAINTING SYSTEM COMPONENTS AND MANUFACTURERS

A. Painting System Manufacturers:

1. Acceptable manufacturers for each generic painting system are referenced in Article 2.1, above. Inclusion of a manufacturer in Paragraph 2.2.A.1 does not mean that any paint systems of that listed manufacturer is automatically considered "equal" to the paint systems of manufacturers referenced under specific generic paint systems in Article 2.1, above.

2. Where two or more manufacturers are included under specific generic paint systems, the products of those manufacturers named are considered "equal" by ENGINEER. Products of other listed, or unlisted, manufacturers shall be submitted to ENGINEER for review, as a substitution and shall conform to Article 2.3, below.
3. Manufacturers for each generic product are specified under the Table of Products, Dry Film Thicknesses and Coverages using the following abbreviations.

4. Product and Manufacturer: Where referenced under generic painting systems, provide painting systems as manufactured by the following:
   a. Tnemec Company, Incorporated. (TCI)
   b. The Carboline Company, part of the StonCor Group, An RMP Company. (TCC)
   c. The Sherwin-Williams Company. (SWC)
   d. RoyalBond Company, a division of Royal Group Technologies Limited. (RBC)

B. Generic Painting System Components:
   1. Provide the following generic products as scheduled in Article 2.1, "Painting Systems":

   **TABLE OF GENERIC PRODUCTS**

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>100 percent volume solids, non-shrinking, trowel-grade modified amine-catalyzed epoxy, recommended by manufacturer's product literature as providing the same high bond strength and resistance to abrasion, impact, wet conditions, corrosive fumes and chemical contact as the product series of manufacturer specified; containing 0.0 pounds per gallon VOC.</td>
</tr>
<tr>
<td>B</td>
<td>Minimum 96 percent volume solids, low-odor, high-build, two-component polyamine- or polyamidoamine-catalyzed epoxy primer; containing 0.33 pounds per gallon VOC, maximum.</td>
</tr>
<tr>
<td>C</td>
<td>100 percent volume solids, fiberglass-reinforced, high-performance, thick-film, polyamine- or polyamidoamine-catalyzed epoxy with a high-gloss finish coat, recommended by manufacturer's product literature as resisting frequent hot water and detergent cleaning and with the same abrasion and stain resistance as the product series of manufacturer specified; containing 0.04 pounds per gallon VOC, maximum.</td>
</tr>
<tr>
<td>D</td>
<td>Minimum 98 percent volume solids, high-build, chemical-resistant, high-gloss polyamine- or polyamidoamine-catalyzed epoxy finish; containing 0.04 pounds per gallon VOC, maximum.</td>
</tr>
<tr>
<td>E</td>
<td>Minimum 56 percent volume solids, high-build, two-component, polyamide-catalyzed epoxy; containing 3.40 pounds per gallon VOC, maximum.</td>
</tr>
<tr>
<td>F</td>
<td>Minimum 80 percent volume solids, high-build, two-component, cycloaliphaticamine-catalyzed epoxy coating, recommended by manufacturer's product literature as providing the same maximum long-term chemical and corrosion protection as the product series of manufacturer specified; containing 1.55 pounds per gallon VOC, maximum.</td>
</tr>
</tbody>
</table>
### G
Minimum 90 percent volume solids, 102 grams styrene per litre VOC, maximum in compliance with FDA CFR 175.300. Painting system shall be unaffected by constant immersion in 17 percent sodium hypochlorite at ambient temperatures. Provide a coating which is a combination of organic and inorganic silicon dioxide molecules with oxirane molecular end caps which when catalyzed results in a homopolymer thermoset resin with a very dense, highly cross-linked molecular structure.

### H
Minimum 64 percent volume solids, high-build, two-component, polyamide-catalyzed epoxy block filler, recommended by manufacturer's product literature as providing the same adhesion to constantly damp surfaces as the product series of manufacturer specified; containing 2.50 pounds per gallon VOC, maximum.

### I
Minimum 68 percent volume solids, high-build, three-component, waterborne cementitious acrylic block filler; containing 0.64 pounds per gallon VOC, maximum.

### J
Minimum 50 percent volume solids, flexible, high-build, single-component, modified waterborne styrenated acrylate coating that can fill and bridge minor hairline cracks and recommended by manufacturer's product literature as providing the same elastomeric protection against rain, alternate freeze-thaw cycles and ultraviolet light as the product series of manufacturer specified; containing 1.19 pounds per gallon VOC, maximum.

### J1
Minimum 56 percent volume solids, flexible, high-build, single-component, modified waterborne, sand textured, styrenated acrylate coating that can fill and bridge minor hairline cracks and which is recommended by Manufacturer's product literature as providing the same elastomeric protection against rain, alternate freeze-thaw cycles and ultraviolet light as the product series of manufacturer specified; containing 0.94 pounds per gallon VOC, maximum.

### K
Minimum 58 percent volume solids, two-component, aliphatic acrylic polyurethane coating, recommended by manufacturer's product literature as providing the same high resistance to abrasion, and color/gloss retention as the product series of manufacturer specified; containing 3.5 pounds per gallon VOC, maximum.

### K1
Minimum 66 percent volume solids, two-component, aliphatic acrylic polyurethane coating, recommended by manufacturer's product literature as providing the same high resistance to abrasion, and color/gloss retention as the product series of manufacturer specified; containing 2.5 pounds per gallon VOC, maximum.
<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>Minimum 57 percent volume solids, three-component, clear aliphatic acrylic polyurethane coating, recommended by manufacturer's product literature as providing four times the color retention capability than uncoated polyurethane surfaces; containing 3.0 pounds per gallon VOC, maximum.</td>
</tr>
<tr>
<td>M</td>
<td>Minimum 72 percent volume solids, two-component, inorganic zinc-rich, ethyl silicate coating containing 2.82 pounds per gallon VOC, maximum.</td>
</tr>
<tr>
<td>N</td>
<td>Minimum 25 percent volume solids, heat-resisting silicone aluminum coating capable of resisting continuous exposure to 1,200°F; containing 5.32 pounds per gallon VOC, maximum.</td>
</tr>
<tr>
<td>O</td>
<td>Minimum 28 percent volume solids single-component, waterborne, vinyl acrylic primer-sealer; containing 1.26 pounds per gallon VOC, maximum.</td>
</tr>
<tr>
<td>P</td>
<td>Minimum 38 percent volume solids, industrial grade, water-based acrylic emulsion; containing 1.87 pounds per gallon VOC, maximum.</td>
</tr>
<tr>
<td>Q</td>
<td>Single-component, self-priming material formulated without the need for petroleum-based or other organic solvents when tested according to EPA Reference Test 24 and which does not contribute to low-level ozone air pollution; containing 0.0 pounds per gallon VOC.</td>
</tr>
<tr>
<td>R</td>
<td>Minimum 69 percent volume solids, two-component, amine-catalyzed epoxy, recommended by the manufacturer's product literature as providing the same maximum long-term chemical and corrosion protection as the product series of manufacturer specified; containing 2.75 pounds per gallon VOC, maximum.</td>
</tr>
<tr>
<td>S</td>
<td>Minimum 17 percent volume solids, two-component, waterborne polyamide epoxy, recommended by the manufacturer's product literature as providing the same adhesion as a tie-coat for styrenated acrylate coatings over wood surfaces as the product series of manufacturer specified; containing 1.42 pounds per gallon VOC, maximum.</td>
</tr>
<tr>
<td>T</td>
<td>Minimum 38 Percent solids, thermoplastic aliphatic polyurethane-acrylic hybrid dispersion.</td>
</tr>
</tbody>
</table>

C. Product Series, Manufacturers, Dry Mil Film Thickness per Coat (DMFTPC), and Coverage:
1. Provide the following products, manufacturers, and features as scheduled in Article 2.1, "Painting Systems":

91st Avenue WWTP Sludge Solar Drying Beds 09900-26 03/30/12
CITY OF PHOENIX: Water Services Department  
PROJECT NAME: 91st Avenue WWTP Sludge Solar Drying Beds  
PROJECT NUMBER: WS90100098

## TABLE OF PRODUCTS, DRY FILM THICKNESSES AND COVERAGES

<table>
<thead>
<tr>
<th>Series</th>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>63-1500 Filler/Surfacer (TCI); Sher-plate Epoxy Patching Compound (SWC)</td>
<td>Patch and fill up to 2-inches deep, 200 cubic inches per gallon. Provide additional coats as required to fill and level patch.</td>
</tr>
<tr>
<td>2</td>
<td>201 Epoxoprim (TCI); Multi-Gard 954 HB (TCC)</td>
<td>One coat, 6.0 to 8.0 dry mils, 150 to 200 square feet per gallon.</td>
</tr>
<tr>
<td>3</td>
<td>270 Stranlok (TCI); Multi-Gard 954 HB with fiber (TCC)</td>
<td>Two coats, 15 to 20 dry mils per coat, 60 to 85 square feet per gallon per coat.</td>
</tr>
<tr>
<td>4</td>
<td>280 Tneme-Glaze (TCI); Multi-Gard 954 HB (TCC)</td>
<td>One coat, 6.0 to 8.0 dry mils, 160 to 214 square feet per gallon.</td>
</tr>
<tr>
<td>5</td>
<td>69N Hi-Build Epoxoline (TCI); CarboGuard 888 (TCC); Epolon II Macropoxy 646 (SWC):</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. One coat, 3.0 to 5.0 dry mils, 140 to 240 square feet per gallon.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. One coat, 4.0 to 6.0 dry mils, 120 to 180 square feet per gallon.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Two coats, 3.0 to 5.0 dry mils per coat, 140 to 240 square feet per gallon per coat.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d. Two coats, 1.5 to 2.5 dry mils per coat, 280 to 475 square feet per gallon per coat.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>e. One coat, 1.5 to 2.5 dry mils, 280 to 475 square feet per gallon.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>f. One coat, 2.0 to 3.0 dry mils, 240 to 360 square feet per gallon.</td>
<td></td>
</tr>
<tr>
<td>5.1</td>
<td>69N Hi-Build Epoxoline (TCI); CarboGuard 888 (TCC); Macropoxy 646 (SWC):</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. One coat, 3.0 to 5.0 dry mils, 140 to 240 square feet per gallon.</td>
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<td></td>
<td>b. One coat, 4.0 to 6.0 dry mils, 120 to 180 square feet per gallon.</td>
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<tr>
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<tr>
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<tr>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>f. One coat, 2.0 to 3.0 dry mils, 240 to 360 square feet per gallon.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>63-1500 Filler/Surfacer (TCI); Sher-plate Epoxy Patching Compound (SWC)</td>
<td>One coat, hand troweled-in-place up to 2-inches deep for patching and applied 1/8-inch thick continuously over all surfaces specified to receive this painting system, 20 square feet per gallon (excluding patched areas), and provided in sufficient additional quantity to bring all surfaces to a smooth, uniform continuously coated plane, of thickness specified.</td>
</tr>
<tr>
<td>Series</td>
<td>Coating Details</td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>-----------------</td>
<td></td>
</tr>
</tbody>
</table>
| 7      | **Series 104 H.S. Epoxy (TCI); Macropoxy 646 (SWC):**  
|        |   a. Two coats, 6.0 to 8.0 dry mils per coat, 130 to 175 square feet per gallon per coat.  
|        |   b. Two coats, 4.0 to 6.0 dry mils per coat, 175 to 260 square feet per gallon per coat.  
|        |   c. One coat, 4.0 to 6.0 dry mils, 175 to 260 square feet per gallon.  
| 7\textsuperscript{i} | **Series 104 H.S. Epoxy (TCI); Macropoxy 646 (SWC):**  
|        |   a. Two coats, 6.0 to 8.0 dry mils per coat, 130 to 175 square feet per gallon per coat.  
|        |   b. One coat, 4.0 to 6.0 dry mils, 175 to 260 square feet per gallon.  
| 7\textsuperscript{a} | **Series 46H High Build Tnemer-Tar (TCI); TarGuard (SWC)** |
| 8      | **Series 20-1255 Pota-Pox (TCI); Epoxide 33/34 (SWC); Super Hi-Gard 891 LT (TCC):** - one coat, 3.0 to 5.0 dry mils, 140 to 240 square feet per gallon.  
| 9      | **Series 20-GB03 Pota-Pox (TCI); Epoxide 33/34 (SWC); Super Hi-Gard 891 LT (TCC):** - one coat, 4.0 to 6.0 dry mils, 120 to 180 square feet per gallon.  
| 10     | **Series 140-1255 Pota-Pox Plus (TCI); Hi-Solids Catalyzed Epoxy (SWC); Super Hi-Gard 894 LT (TCC):** - one coat, 6.0 to 8.0 dry mils, 110 to 145 square feet per gallon.  
| 11     | **Series 140-GB03 Pota-Pox Plus (TCI); Hi-Solids Catalyzed Epoxy (SWC); Super Hi-Gard 894 LT (TCC):** - one coat, 6.0 to 8.0 dry mils, 110 to 145 square feet per gallon.  
| 12     | **Series 54-660 Masonry Filler (TCI); Kem Cati-Coat HS Epoxy Filler/-Sealer (SWC):** - one coat, 10.0 dry mils, 75 to 100 square feet per gallon.  
| 13     | **Series 130 Envirofill (TCI); Cement-Plex 875 Block Filler (SWC):** - one coat, 10 to 14 dry mils, 60 to 80 square feet per gallon.  
| 14     | **Series 156 Enviro-Crete (TCI); Heavy Duty Block Filler (SWC):** - one coat, 6.0 to 8.0 dry mils, 80 to 100 square feet per gallon.  
| 15     | **Series 157 Enviro-Crete (TCI):** - one coat, 6.0 to 8.0 dry mils, 90 to 120 square feet per gallon.  
| 16     | **Series 73 Endura-Shield (TCI), Carboiline 133 HB (TCC); Acrolon 218 (SWC):** - one coat, 2.0 to 3.0 dry mils, 240 to 370 square feet per gallon.  
| 17     | **Series 1074 Endura-Shield (TCI); Carbothane 134 HG (TCC); Acrolon 218 (SWC):** - one coat, 2.0 to 3.0 dry mils, 290 to 430 square feet per gallon.  
| 18     | **Series 76 Endura-Clear (TCI); Diamond-Clad Urethane Clear Coat (SWC); Carbothane Clear Coat Gloss (TCC):** - one coat, 1.5 to 2.0 dry mils, 430 to 580 square feet per gallon.  
| 19     | **Series 90-96 Tneme-Zinc (TCI); Carbo Zinc 11 HS (TCC); Zinc Clad II HS (SWC):** - one coat, 2.5 to 3.5 dry mils, 260 to 370 square feet per gallon.
20 Series 39-1261 Silicone Aluminum (TCI); Kem Hi-Temp No. 1200-MSF (SWC); - two coats, 1.0 to 1.5 dry mils per coat, 200 to 300 square feet per gallon per coat.

21 Series 51-792 PVA Sealer (TCI); Pro-Mar 200 (B20W200) Latex Wall Primer (SWC); Multi-Bond 120 (TCC); - one coat, 1.0 to 2.0 dry mils, 180 to 360 square feet per gallon.

22 Series 6 Tneme-Cryl (TCI); DTM Acrylic Coating (SWC); Series 3358-3359(primer and topcoat) (TCC); - one coat, 2.5 to 3.0 dry mils, 180 to 220 square feet per gallon.

23 HealthSpec (SWC); - two coats, 1.5 to 2.5 dry mils per coat, 150 to 250 square feet per gallon per coat.

24 Series 151 Elasto-Grip (TCI); - one coat, 1.5 to 2.5 dry mils, 140 to 240 square feet per gallon.

25 Waterborne RoyalBond (RBC); - one light fog coat

26 Waterborne RoyalBond (RBC); - minimum two coats, minimum 50 microns (2.0 mils) dry thickness.

2.3 SUBSTITUTIONS

A. No products that decrease the film thickness, the surface preparation, VOC's, solids by volume or the generic type of coating specified shall be considered. Approved manufacturers shall furnish the same color selection as the manufacturers specified, including accent colors and custom colors in all coating systems, and shall document satisfactory performance of their coating system for at least two treatment plants that have been in service at least three years each.

2.4 PIPING MARKERS

A. General:
1. For pipes over 3/4-inch outside diameter: Provide painted pipe markers.
2. For pipes under 3/4-inch outside diameter: Provide aluminum tags, totally compatible with service conditions, 1-1/2-inch diameter, with depressed 1/4-inch high black filled letters above 1/2-inch high black filled numbers.
3. Each marker shall consist of at least one legend descriptive of the function of the pipe and a directional arrow.
4. The size of lettering and marker shall conform to ANSI A13.1.
5. Location of Markers:
   a. Adjacent to each valve and "T" connection.
   b. At each branch and riser takeoff.

91st Avenue WWTP Sludge
Solar Drying Beds 09900-29 03/30/12
PART 3 - EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions under which painting Work is to be performed and notify ENGINEER, in writing, of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to the formation of a durable paint film capable of performing in accordance with claims made in manufacturer's product literature for the surfaces and conditions encountered. Do not paint over “UL” or similar labels, including mechanical and electrical Manufacturer nameplates.

C. Do not paint over existing paint where there is no assurance that existing paint will provide an acceptable surface for the long-term adherence and durability of painting systems specified or where the manufacturer requires removal of all existing paint in order to recommend the use of the specified painting system.

D. Quality Assurance: Surface preparation shall be based upon comparison with: "Pictorial Surface Preparation Standards for Painting Steel Surfaces," SSPC-Vis 1 ASTM Designation D220, NACE Standard TM-01-70; and as described below. Anchor profile for prepared surfaces shall be measured by using a nondestructive instrument such as a Keane-Tator Surface Profile Comparator or Testix Press-O-Film System. Temperature and dewpoint requirements noted herein shall apply to all surface preparation operations, except minimum temperature shall be 40°F. To facilitate inspection, CONTRACTOR on the first day of abrasive blasting operations, abrasively blast metal panels furnished by CONTRACTOR to the standard specified. These panels shall be equivalent to plates or structural stock used in facility with minimum measurements of 8-1/2-inches by 11-inches or nearest multiple for structural shapes. After agreeing a specific panel meets the requirements of the Specifications, the panel shall be initialed by CONTRACTOR and ENGINEER and coated with a clear non-yellowing finish. Panels shall be utilized for inspection purposes throughout the duration of abrasive blasting operations.

E. Prove an independent inspector with a Level 3 NACE International Certification conduct inspections on the coating/painting system. The interior and exterior of all pumps, pump can, surge tank, any piece of equipment or vessel in continuous contact with potable water shall be specially inspected by the NACE certified coating inspector during the coating application process. If any deficiencies are
found, they must be corrected prior to application. This inspector shall be third-party and in addition to the manufacture’s regular inspection. The coatings installation shall be certified. A report of inspections shall be maintained and submitted for review. After the coatings installations are complete, the coating must pass a 100 percent holiday test over 100 percent of any surface to be submersed.

F. See Paragraph 3.5 below for additional inspection and quality control requirements.

3.2 SURFACE PREPARATION

A. General:
1. Prior to performing testing for moisture content, or any other tests, all parties shall agree upon the acceptable results, methods of testing, and the proper course of action that will be taken in case the acceptable limits are exceeded. Excessive moisture, or other conditions, may impact the Project Schedule.
2. Prior to any surface preparation covered in this section, all surfaces should meet the acceptable conditions required.
4. Prepare existing and new surfaces required to be painted as specified for new surfaces. Where CONTRACTOR proposes other methods of preparing existing surfaces they shall be submitted to ENGINEER for approval at time of Shop Drawing submittal. ENGINEER'S approval of alternative surface preparation methods shall not relieve CONTRACTOR of performance required under this Section.
   a. Clean and roughen surfaces of existing paint and other decorative or protective toppings on surfaces to remain, that are identified to receive a painting system under this Section, to provide surfaces acceptable for application of painting system specified.
   b. Where existing surfaces to be painted display corrosion, peeling paint, or unacceptably adhering coatings, remove all topcoats, primers, intermediate coats of paint and other protective or decorative coatings to provide surfaces acceptable for application of painting system specified.
   c. Where coal-tar coated Ductile-Iron Piping and fittings is used above ground the surface preparation shall be abrasive blasted to SP-10, followed by prime and finish coats. The surface preparation shall be verified by the ENGINEER prior to any other coats being applied.

5. Perform all preparation and cleaning procedures as specified herein and in strict accordance with paint manufacturer's approved instructions for each particular surface and atmospheric condition.
6. Remove all hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items already in-place and that does not require field painting, or provide effective surface-applied protection prior to surface preparation and painting operations.

7. Remove, as necessary, items, which must be field-painted where adjacent surfaces cannot be completely protected from splatter or overspray. Following completion of painting of each space or area, the removed items shall be reinstalled by workers skilled in the trades involved.

8. Clean surfaces to be painted before applying any painting system components. Remove oil and grease with clean cloths and cleaning solvents prior to mechanical cleaning.

9. Coating products shall not be applied until the ENGINEER has inspected the materials and the coating manufacturer's technical representative has instructed CONTRACTOR and ENGINEER in the surface preparation, mixing and application of each coating.

B. Cast-In-Place Concrete, Precast Concrete and Masonry Surfaces:

1. Prepare surfaces of concrete masonry units to be painted in accordance with SSPC-SP 13/NACE 6 by removing all efflorescence, chalk, dust, dirt, grease, oils, and other contamination, with soap and water. All surfaces shall be clean and dry at the time of paint system application.

2. Concrete masonry units that cannot be adequately cleaned by soap and water shall be acid etched with a commercial solution of 15 percent muriatic acid.

3. Prepare and clean all surfaces of cast-in-place concrete and precast concrete in compliance with ASTM D 4259 to obtain a uniform and continuous anchor profile of approximately one mil. Provide mechanical abrading procedures and abrasive blasting procedures as specified in ASTM D 4259. Use 40 to 80-mesh abrasive and clean, dry, compressed air. Compressed air cleanliness shall be in compliance with ASTM D 4285. Pressure at blasting nozzle shall not exceed 80 psi. Do not concentrate blast on surface but move at a fairly rapid rate to provide a surface free of laitants and contaminants. Provide post-surface preparation cleaning in accordance with ASTM D 4258 to remove loose material. Surface preparation shall open all surface air holes by removing all laitance shoulders surrounding the air holes. Vacuum all surfaces to remove all dust and sand and wash with potable water.

4. Where paint system is used to provide chemical containment barrier protection, repair cracks and expansion joints in concrete and provide 2-inch radiused cove base fillets at all equipment pads and containment walls as part of the complete chemical containment paint system Work. Use materials and techniques recommended by the specified Manufacturer.

5. Remove all cast-in-place concrete fins, projections and other surface irregularities, which would protrude above the level of finished intermediate fillers and surfacers by chipping and scarification by mechanical abrasion.

6. Using specified filler and surfacer, patch all cast-in-place concrete and precast concrete surfaces as required to completely fill surface air holes and
honeycombing. Level all protrusions and grind filler and surfacing compounds smooth and level with adjacent surfaces.

7. Perform tests in compliance with ASTM D 4262 and ASTM D 4263 in order to verify the alkalinity and moisture content of the surfaces to be painted and report findings to ENGINEER. If, in the opinion of ENGINEER, the surfaces are sufficiently alkaline to cause blistering and burning of the paint, correct this condition before application of paint. Provide suitable testing materials in order to carry out alkalinity and moisture tests. Do not paint over surfaces where the moisture content exceeds eight percent.

8. Where a concrete masonry unit block filler is specified, spot patch holes and cracks with a putty knife using specified block filler. Apply to large surfaces by airless spray and backroll uniformly using a roller with a synthetic nap cover. Follow with a rubber squeegee in order to provide a smooth finish.

C. Ferrous Metals:

1. Comply with manufacturer's recommendations for type and size of abrasive in order to provide a surface profile meeting manufacturer's painting system requirements for type, function and location of surface. Verify that manufacturer recommended profiles have been achieved on prepared surfaces. Report profiles to ENGINEER using Test Method C in compliance with ASTM D 4417.

2. Clean non-submerged ferrous surfaces including structural steel and miscellaneous metal to be shop-primed, of all oil, grease, dirt, mill scale and all other contamination by commercial blast cleaning complying with SSPC-SP6, at the time of paint system application, using SSPC VIS 1 as a standard of comparison.

3. Clean submerged ferrous surfaces including structural steel and miscellaneous metal to be shop-primed, of all oil, grease, dirt, mill scale and all other contamination by near-white blasting complying with SSPC-SP10, at the time of paint system application, using SSPC VIS 1 as a standard of comparison.

4. Clean non-submerged, ferrous surfaces that have not been shop-coated of all oil, grease, dirt, loose mill scale and all other contamination by commercial blasting complying with SSPC-SP6, at the time of painting system application, using SSPC VIS 1 as a standard of comparison.

5. Clean submerged ferrous surfaces that have not been shop-coated or that have been improperly shop-coated, of all oil, grease, dirt, mill scale and all other contamination by near-white blasting complying with SSPC-SP10, at the time of painting system application, using SSPC VIS 1 as a standard of comparison.

6. Touch-up shop-applied prime coats which have damaged or have bare areas, with primer recommended by manufacturer after commercial blasting complying with SSPC-SP6, at the time of painting system application, using SSPC VIS 1 as a standard of comparison, to provide a surface profile of not less than one mil.
7. Power tool clean, complying with SSPC-SP3, in order to remove welding splatter and slag.
8. Remove all rust and contamination on existing ferrous metals to sound surfaces by power tool cleaning complying with SSPC SP11 to provide a surface profile of not less than one mil.
9. All shop primed items shall be re-blasted in the field and reprimed prior to being finish coated. No equipment that has been shop primed and finish coated shall be field painted, unless it has been reblasted, reprimed and finish coated in the field.
10. Be aware that the SSPC-VIS 1 Standard does not provide a reference for SSPC-SP 6 for new steel, Rust Grade A. This is due to the requirement to remove all mill scale. When this condition is achieved, the result will be SSPC-SP 10 or SSPC-SP 5, and these are the only visual standards shown for SSPC-SP 6, Rust Grade A. Conform to this requirement at no additional cost to the OWNER.

D. Non-Ferrous Metal Surfaces: Prepare all non-ferrous metal surfaces for painting by light whip-blasting or by lightly sanding with 60 to 80 mesh sandpaper.

E. Galvanized (Zinc-Coated) Surfaces: Prepare all galvanized surfaces for painting by lightly sanding with 60 to 80 mesh sandpaper or by light whip blasting.

F. CPVC Piping and Fiberglass: Lightly sand and clean all surfaces to be painted. Fiberglass surfaces shall be prepared by solvent washing to remove wax and other contaminants before abrading surfaces with 60 to 80 mesh sandpaper to give an anchor pattern providing scratches no further apart than 1/16-inch.

G. Covering on Pipe Insulation:
1. Remove all oil and surface contaminants as recommended by manufacturer for surface and application required.
2. Do not cut or damage the insulation in any way.

H. Gypsum Wallboard and Plaster:
1. Patch, sand and seal all rough spots before apply prime coat. Remove all dust and other contaminants prior to painting.
2. Touch-up all suction spots and hot spots with primer before application of finish coats.

I. Wood:
1. Clean wood surfaces to be painted of all dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those finished surfaces exposed to view, and dust off.
2. Prime, stain, or seal wood required to be site painted immediately upon delivery to job. Prime edges, ends, faces, undersides, and backsides of such wood, including cabinets, counters, cases, paneling and similar items.
3. Backprime paneling or interior partitions only where masonry, plaster, or other wet wall construction occurs on backside.
4. Seal tops, bottoms and cut-outs of wood doors with a heavy coat of sealer as recommended by the door manufacturer immediately upon delivery to site.
5. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer, before application of the priming coat.
6. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler as recommended by manufacturer, sandpaper smooth when dried and dust off.

3.3 MATERIALS PREPARATION

A. General:
1. Mix and prepare painting materials in strict accordance with manufacturer's product literature.
2. Do not mix painting materials produced by different manufacturers, unless otherwise permitted by manufacturer's instructions.
3. Where thinners are required in the Work, they shall be produced by the paint system manufacturer, unless otherwise permitted by the manufacturer's product literature, submitted to ENGINEER at the time of Shop Drawing approval.

B. Tinting:
1. Tint each undercoat a lighter shade to facilitate identification of each coat of paint where multiple coats of the same material are to be applied.
2. Tint undercoats to match the color of the finish coat of paint, but provide sufficient difference in shade of undercoats to distinguish each separate coat. Provide a code number to identify material tinted by the manufacturer.

C. Mixing:
1. For those products requiring constant agitation use methods in compliance with manufacturer's product literature, to prevent settling during paint application.
2. Mix only in containers placed in suitably sized non-ferrous or oxide resistant metal pans to protect concrete floors from slashes or spills which could stain exposed concrete or react with subsequent finish floor material.
3. Mix and apply paint only in containers bearing accurate product name of material being mixed, or applied.
4. Stir all materials before application to produce a mixture of uniform density, and as required during the application of the materials. Do not stir any film, which may form on the surface into the material. Remove the film and, if necessary, strain the material before using.
5. Strain products requiring such mixing procedures. After adjusting mixer speed to break up lumps and after components are thoroughly blended, strain through 35 to 50 mesh screen before application.

3.4 APPLICATION

A. General:
1. Apply paint systems by brush, roller, or airless spray in accordance with manufacturer's recommendations and in compliance with Paint Application Specifications No. 1 in SSPC Vol. 2, where applicable. Use brushes best suited for the type of material being applied. Use rollers of carpet, velvet back, or high pile sheep’s wool as recommended by manufacturer for material and texture required. Use air spray and airless spray equipment recommended by manufacturer for specific painting systems specified. Coated surfaces shall be free from runs, drops, ridges, waves, laps and brush marks. Submit a list of application methods proposed, listing paint systems and location.

2. Paint dry film thicknesses required are the same regardless of the application method. Do not apply succeeding coats until the previous coat has completely dried.

3. Apply additional coats when undercoats, stains, or other conditions show through the final coat of paint, until the paint film is of uniform finish, color and appearance. This is of particular importance regarding intense chroma primary colors. Ensure that all surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a film thickness equivalent to that of flat surfaces.

4. Surfaces of items not normally exposed-to-view do not require the same color as other components of the system of which they are a part, but require the same painting system specified for exposed surfaces of the system.

5. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint before final installation of registers or grilles.

6. Paint the backs of access panels, and removable or hinged covers, to match the exposed surfaces.

7. Paint aluminum parts in contact with dissimilar materials with specified paint system.

8. Paint exterior doors on tops, bottoms, and side edges, the same as exterior surfaces.

9. Omit field-applied primer on metal surfaces, which have been primed in the shop. Touch-up paint shop-primed coats and pre-finished items only when approved by ENGINEER using compatible primers and manufacturer's recommended compatible field-applied finishes.

10. Welds shall be stripe-coated with intermediate or finish coat of paint after application of prime coat.
B. Minimum/Maximum Paint Film Thickness:
   1. Apply each material at not less than, nor more than, manufacturer's recom-
      mended spreading rate, and provide total dry film thickness as specified.
   2. Apply additional coats of paint if required to obtain specified total dry film
      thickness.
   3. Maximum dry film thickness shall not exceed 100 percent of minimum dry
      film thickness, except where more stringent limitations are recommended by
      the paint manufacturer for a specific product.

C. Scheduling Surface Preparation and Painting:
   1. Apply the first-coat material to surfaces that have been cleaned, pretreated or
      otherwise prepared for painting as soon as practicable after preparation and
      before subsequent surface deterioration in consideration of the atmospheric
      conditions existing at the time of surface preparation and painting. Surfaces
      that have started to rust before first-coat application is complete shall be
      brought back to required standard by abrasive blasting.
   2. Allow sufficient time between successive coats to permit proper drying. Do
      not recoat until paint has dried to where it feels firm, does not deform or feel
      sticky under moderate thumb pressure, and the application of another coat of
      paint does not cause lifting or loss of adhesion of the undercoat.
   3. Scarify primers and other painting system components by brush-blasting if
      paint has been exposed for lengths of time or under conditions beyond
      manufacturer's written recommendations for the painting systems involved,
      the intended use, or the method of application proposed for subsequent coats
      of paint.
   4. Schedule cleaning and painting so that dust and other contaminants from the
      cleaning process will not fall on wet, newly painted surfaces.

D. Prime Coats: Recoat primed and sealed walls and ceilings where there is
   evidence of suction spots or unsealed areas in first coat, to assure a finish coat
   with no burn-through or other defects caused by insufficient sealing.

E. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth
   surface of uniform finish, color, appearance, and coverage.

F. Brush Application:
   1. Brush-out and work all brush coats onto the surfaces in an even film. Cloudiness,
      spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface
      imperfections will not be acceptable. Neatly draw all glass and color break lines.
   2. Brush apply all primer or first coats, unless otherwise permitted to use
      mechanical applicators.

G. Mechanical Applicators:
1. Use mechanical methods for paint application when permitted by governing ordinances, manufacturer, and approved by ENGINEER.

2. Limit roller applications, if approved by ENGINEER, to interior wall finishes for second and third coats. Apply each roller coat to provide the equivalent hiding as brush-applied coats.

3. Wherever spray application is used, apply each coat to provide the equivalent hiding of brush-applied coats. Do not double back with spray equipment for the purpose of building up film thickness of two coats in one pass.

4. CONTRACTOR’S equipment shall be designed for application of the materials specified. Compressors shall have suitable traps and filters to remove water and oils from the air. A paper blotter test shall be performed by CONTRACTOR when requested by the ENGINEER to determine if the air is sufficiently free of oil and moisture to not produce deteriorating effects on the coating system. The amount of oil and moisture in spray air shall be less than the amount recommended by the coating manufacturer. Spray equipment shall be equipped with mechanical agitators, pressure gages and pressure regulators and spray nozzles of the proper sizes.

H. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish, or repaint Work not in compliance with specified requirements as required by ENGINEER.

3.5 FIELD QUALITY CONTROL

A. Prior to initiating painting Work, perform adhesion tests on existing surfaces to be painted. Perform testing in compliance with ASTM D 4541 or other method acceptable to ENGINEER. The number and location of tests shall be sufficient for CONTRACTOR to determine the condition of existing coatings and the suitability of existing coatings to remain to provide an acceptable substrate for new coatings. Submit testing plan prior to testing and provide ENGINEER a copy of adhesion test results.

B. The right is reserved by ENGINEER to invoke the following material testing procedure at any time, and any number of times, during the period of field painting:

1. Engage the service of an independent testing laboratory to sample any of the paints being used. Samples of materials delivered to the site will be taken, identified and sealed, and certified as to being the material actually applied to the surfaces in each area, in the presence of CONTRACTOR.

2. A testing laboratory, selected by OWNER, will perform appropriate tests for any or all of the following characteristics:
   a. Abrasion resistance.
   b. Apparent reflectivity.
   c. Flexibility.
   d. Washability.
C. Notify ENGINEER after completion of each coat of paint. After inspection and checking of film thickness, and for other imperfections, and after approval by ENGINEER, proceed with the succeeding coat. Manufacturer’s maximum time between coats for the ambient conditions shall be reviewed prior to beginning work and coats shall be completed in accordance with manufacturer’s recommendations. Purchase for OWNER two new dry-film thickness gages for checking the film thickness and one set of visual standards to check surface preparation. Calibrate dry film thickness gage at the site using Bureau of Standards standard shim blocks. Provide one holiday detector for holiday testing. The holiday detector will remain the property of CONTRACTOR.

1. Product and Manufacturer: Provide the following:
   a. Film Thickness Tester: Model FM-III as manufactured by Mikrotest, (Furnish Two).
   b. Holiday Detector: Model M-1 as manufactured by Tinker & Rasor.

2. ENGINEER shall witness all holiday testing and shall be notified of all scheduled testing 24 hours in advance.

3. Additional coats shall be applied, if required, to produce the specified film thickness and to correct holidays and to completely fill all surface air holes.

4. Holiday testing shall be performed by CONTRACTOR.

D. For magnetic substrates, measure thickness of dry film nonmagnetic coatings following recommendations of SSPC-PA 2. These procedures are intended to supplement manufacturers’ approved instructions for the manual operation of measurement gages and are not intended to replace them.

E. After the CONTRACTOR has inspected and approved any and all surface preparation to receive coatings, the ENGINEER shall be notified and inspect all surfaces preparation prior to coating. Any deficiencies noted shall be corrected prior to coating application.
3.6 PROTECTION

A. Provide "Wet Paint" signs as required to protect newly painted finishes. Remove all temporary protective wrappings provided for protection of this Work and the work of other contractors after completion of painting operations.

3.7 ADJUSTMENT AND CLEAN-UP

A. Correct all damages to the work of other trades by cleaning, repairing or replacing, and repainting, as acceptable to ENGINEER.

B. During the progress of the Work, remove from the site all discarded paint materials, rubbish, cans and rags at the end of each work day.

C. Upon completion of painting, clean all paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

D. At the completion of Work of other trades, touch-up and restore all damaged or defaced painted surfaces as determined by ENGINEER.

3.8 WARRANTY

A. Warranty inspection shall be conducted during the eleventh month following completion of the Work. All defective Work shall be repaired by CONTRACTOR in accordance with the requirements of this Section and to the satisfaction of the ENGINEER, at no additional cost to the OWNER.

B. Any location where paint has peeled, bubbled, or cracked and any location where rusting is evident shall be considered to be a failure of the system. Make repairs at all points where failures are observed by removing the deteriorated paint, cleaning the surface, and re-coating or repainting with the same system. If the area of failure exceeds 25 percent of the total coated or painted surface, the entire coating or paint system may be required to be removed and repainted in accordance with this Section as determined by the ENGINEER.

C. All costs for CONTRACTOR'S inspection, manufacturer's inspection and all costs for repair shall be borne by CONTRACTOR.
(The remainder of this page was left blank intentionally.)
### PAINT APPLICATION LOG

<table>
<thead>
<tr>
<th>AREA/LOCATION/EQUIPMENT (DESCRIPTION &amp; SQ FOOTAGE)</th>
<th>DESCRIPTION OF WORK</th>
<th>MATERIALS</th>
<th>EQUIPMENT/PERSONNEL</th>
<th>WFT/PROFILE (MILS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of Area(s): Abrasive Blast,</td>
<td>Product Name and No., Color,</td>
<td>Airless Model No.,</td>
<td>Results,</td>
<td></td>
</tr>
<tr>
<td>Building Name and No., Spray - Prime Coat,</td>
<td>Batch No.’s, Abrasive Size and Type,</td>
<td>Gun and Tip,</td>
<td>No. of</td>
<td></td>
</tr>
<tr>
<td>Basin or Tank Name and No., Brush &amp; Roll -</td>
<td>Amount used (not including waste),</td>
<td>Compressor Size,</td>
<td>readings</td>
<td></td>
</tr>
<tr>
<td>Yard Location, etc. Finish Coat, etc.</td>
<td>etc.</td>
<td>Pot Size,</td>
<td>/ unit.</td>
<td></td>
</tr>
</tbody>
</table>

**Approx. Size/Square Footage.**

**Nozzle Size,**

**No. of Men, etc.**

### AMBIENT CONDITIONS:

<table>
<thead>
<tr>
<th>AREA</th>
<th>TIME</th>
<th>WTHER</th>
<th>AIR °F</th>
<th>SURF °F</th>
<th>DEW °F</th>
<th>RH%</th>
</tr>
</thead>
</table>

### QC DATA:

**List all Quality Control Procedures,**

**Test Methods and Results,**

**Reference Standards, etc.**

**SIGNATURE: _______________________________**

++ END OF SECTION ++
SECTION 11000

ELECTRIC MOTORS 250 HORSEPOWER OR LESS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
1. This Section includes alternating current induction motors, 250 horsepower or less, to be provided with the driven equipment. Unless specified otherwise, electric motors shall be provided by the manufacturer of the driven equipment under an assumption of unit responsibility. This Section refers to motors by enclosure type as defined in NEMA MG 1, except as noted.

B. Horsepower Rating:
1. Motor horsepower ratings noted in individual equipment Specifications are estimates only and it is the responsibility of CONTRACTOR to furnish motors, electric circuits, and other equipment of ample horsepower capacity to operate the equipment furnished without exceeding the manufacturer’s nameplate full-load current at rated manufacturer’s nameplate voltage. Full-load current information shall be furnished with the individual submittals.

1.2 QUALITY ASSURANCE

A. General: Motors shall be built in accordance with UL 674, UL 1004, NEMA Standard MG 1, and to the requirements specified.

B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
1. AFBMA 9: Load Rating and Fatigue Life for Ball Bearings.
2. AFBMA 11: Load Ratings and Fatigue Life for Roller Bearings.
4. IEEE 841, Standard for Petroleum and Chemical Industry - Totally Enclosed Fan Cooled (TEFC) Squirrel Cage Induction Motors - Up to and Including 500 HP.
5. NEMA ICS 2: Industrial Control Devices, Controllers and Assemblies.
6. NEMA ICS 6: Enclosures for Industrial Controls and Systems.
7. NEMA 250, Enclosures for Electrical Equipment (1000 volts maximum).
8. NEMA MG 1: Motors and Generators.
9. NEMA MG1-31: Application Considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and General Purpose Motors Used with Adjustable-Voltage or Adjustable-Frequency Controls or Both.
10. UL 674: Electric Motors and Generators for Use in Class I Division I Hazardous Locations
11. UL 1004: Electric Motors.

C. Factory Tests:

The manufacturer's factory motor Prototype Tests per IEEE Standard 112 Appendix-A on motors through 250 horsepower shall be submitted as Product Data for the motor, and actual factory tests for motors are not required:
1. Winding resistance in ohms and converted to 25 degree C.
2. Resistive Unbalance and Quarter Voltage Impedance, as applicable.
3. Locked-Rotor current (Single phase).
5. No-Load Excitation (volts, amperes, RPM).
7. Efficiency, Power Factor, Current at 115%, 100%, 75%, 50%, and no load.

D. Warranty:
Motors ½ horsepower and greater shall be warranted against defects in materials and workmanship for a period of 5 years under the specified uses and with normal operation and service. This warranty shall be delivered, in writing, to the Owner and shall include, as a minimum, 100 percent full payment coverage for parts and labor during the first 60 months of operation.

E. Unit Responsibility: Assign Unit Responsibility as specified in Section 01600, General Equipment Provisions, to the manufacturer or supplier for the equipment specified in this Section. A Certificate of Unit Responsibility shall be provided.

1.3 SUBMITTALS

A. Submittals shall include the following:
1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a
number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Construction Manager shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications.

Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

1. Manufacture completed IEEE Standard 841 Date Sheet for AC Squirrel Cage Induction Motors with required factory data of motors supplied.
2. Speed-Torque curve per 1.2 C Factory Tests.
3. Factory Test Data: Including Guaranteed Minimum Efficiency for 115% load, 100% load, 75% load, 50% load, and no load.
4. Guaranteed vibration level when measured per MG 1, Figure 7-6:
   a. Displacement: 0.0025 inch peak-to-peak
   b. Velocity: 0.10 inches per second peak
   c. Acceleration: 1g (gravity) peak.
5. Motor heating curve for motors per 1.2 C Factory Tests.
7. Manufacturer's descriptive information relative to motor features.
8. Response curve where a winding over-temperature device is required.
9. For all inverter duty motors: Manufacturer's certification that the motor is compatible with the adjustable frequency drive to be used.
10. Disassembly and repair documentation.

1.4 POWER SUPPLY VARIATIONS

A. Motors shall operate successfully under running conditions at rated load with +/- 10-percent of rated voltage with rated frequency or +/- 5-percent of rated frequency with rated voltage.

1.5 AMBIENT CONDITIONS

A. Unless specified otherwise, motors shall be suitable for continuous operation at an elevation of approximately 1,000 feet above mean sea level. Motors to be installed outdoors, exposed to the weather, shall be suitable for continuous operation in a 50° C ambient temperature; motors to be installed indoors shall be suitable for continuous operation in 50° C ambient temperature, unless otherwise noted.

1.6 NEMA WINDING TEMPERATURES
A. NEMA MG 1 Table 12-7 motors insulation system maximum winding temperatures in degrees-Centigrade (C), with the degrees-Fahrenheit (F) insulation system class specified herein.
   1. Forty degree-C ambient (104 degree-F) is the basis for temperature rise.
   2. For 50 degree-C ambient (122F) and above, refer to the driven equipment specifications for additional requirements.

<table>
<thead>
<tr>
<th>Insulation System Class</th>
<th>Degrees C / F</th>
<th>Temperature Rise by Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>140 / 284</td>
<td>NA</td>
</tr>
<tr>
<td>B</td>
<td>165 / 329</td>
<td>B-rise: 40 + 80 = 120 Degrees C / 248 F</td>
</tr>
<tr>
<td>F</td>
<td>190 / 374</td>
<td>F-rise: 40 + 105 = 145 Degrees C / 293 F</td>
</tr>
<tr>
<td>H</td>
<td>215 / 419</td>
<td>H-rise: 40 + 125 = 165 Degrees C / 329 F</td>
</tr>
</tbody>
</table>

1.7 NEMA MOTOR TEMPERATURE PROTECTION TYPES

A. The NEMA design shall limit the temperatures of the windings without using a thermal device:
   1. Type-1: Winding Running and Locked Rotor Over-temperature Protection.

PART 2 - PRODUCTS

2.1 MANUFACTURER’S NAMEPLATES

A. Factory installed manufacturer’s nameplates shall be stainless steel with embossed or pre-printed lettering and fastened to the motor frame with Type 316 stainless steel pins. Manufacturer’s nameplates shall have stamped on them the motor manufacturer’s name, design voltage; number of hertz and phase; horsepower rating; amperage and temperature rise at rated load, full load speed, NEMA code letter, service factor, minimum guaranteed efficiency, model number, AFBMA bearing number, serial number and maintenance manual number in accordance with NEMA MGI-10.40.1.

B. A separate factory installed manufacturer’s nameplate shall provide lubrication instructions and a separate manufacturer’s nameplate connection diagram for dual voltage motors.
C. Additionally, factory to provide the following information on manufacturer’s nameplates or additional manufacturer’s nameplates for:

1. Motors 1/2 horsepower and larger: Indicate the ABMA L-10 rated life for the motor bearings.
2. Motors 2 to 50 horsepower: Indicate the NEMA nominal efficiency.
4. Explosion-Proof motors: Indicate UL frame temperature limit code.
5. Space heater information.
6. NEMA MG 1 Over Temperature Protection Type Number.

2.2 CONSTRUCTION

A. Unless specified otherwise, all motors provided under this Section shall have the following features of construction and operation:

1. Motor voltage, speed and enclosures are specified in the detailed equipment Specifications. Motors furnished with equipment shall comply with this Section.
2. All motors shall be of the motor manufacturer’s premium energy-efficient design, different from manufacturer’s standard product through the use of premium materials, design and improved manufacturing process, that reduces motor losses approximately 40 percent from standard efficient designs.
3. Motor efficiency shall be determined in accordance with NEMA Standard MG1-12.54.1 and guaranteed minimum full load efficiency labeled on manufacturer’s motor nameplate in accordance with NEMA Standard MG1-12.54.2 or MG1-10.40.1 below.
4. Minimum efficiencies shall not be less than those listed in Paragraph 2.4.E., below.
5. All motors shall successfully operate under power supply variations in accordance with NEMA MG1-14.30.
6. All motors shall be NEMA Design B with torque and starting currents in accordance with NEMA MG1-12.35 and 12.37, except in special applications requiring higher starting torques where NEMA Design C is permitted.
7. All motors shall have a 1.15 service factor. Polyphase integral horsepower motors shall be sized so that, under maximum load conditions imposed by the driven equipment, for the conditions specified, the manufacturer’s motor nameplate rated horsepower and Class B temperature rise will not be exceeded. Motors with a service factor of 1.15 shall be selected for operation within their full load rating without applying the service factor.
8. Each motor shall be of the speed and horsepower specified or required to properly operate the driven equipment, torque characteristics as required by the drive load and suitable for direct coupling or V-belt drive, as
shown on the Drawings and specified herein. Motors shall be designed for full voltage starting, unless otherwise specified.

9. Frames shall be of corrosion-resistant cast iron with integrally cast feet or bases. End bells, conduit box and cover and bases shall be cast iron, with precision machined bearing fits, ASTM Type A-48, Class 25 or better. UL approved automatic stainless steel breather drains shall be provided in the lowest part of front and back brackets to allow drainage of condensation on TEFC and explosion proof motors.

10. Each stator core assembly shall consist of stacked lamination made from specially selected electrical sheet silicon steel.

11. Insulation materials shall be non-hygroscopic and meet or exceed Class H definition, utilizing materials and insulation systems evaluated in accordance with IEEE 117 classification tests. Motor temperature rating shall not exceed Class B temperature limits as measured by resistance method when the motor is operated at full load at 1.0 service factor continuously in a maximum ambient temperature of 50° C. Windings shall be copper.

12. Rotor cages for motors 50 HP or less shall be die cast aluminum or fabricated copper. Shafts shall be made from carbon steel. Rotor cages for motors larger than 50 HP shall be copper only.

13. Rotors on frames 213T and above shall be keyed shrunk or welded to shaft and rotating assembly dynamically balanced to NEMA limits in accordance with MG1-12.06. Balance weights, if required, shall be secured to the rotor resistance ring or fan blades by rivets. Machine screws and nuts are prohibited. The entire rotating assembly between bearing inner caps shall be coated with a corrosion-resistant epoxy.

14. Bearings shall be ball, open, single row, deep groove, Conrad type, and shall have a Class 3 internal fit conforming to AFBMA Std. 20. For belted duty applications, drive end bearing may be cylindrical roller type. Bearings shall be selected to provide L-10 rating life of 100,000 hours minimum. Calculations shall be based on external loads using NEMA applications limits in accordance with MG1-14.41 and typical sheave weights and internal loads defined by the manufacturer, including magnetic pull and rotating assembly weight.

15. Bearing temperature rise at rated load shall not exceed 60° C. Temperature rise shall be measured by RTD or thermocouple at bearing outer race. Bearing AFBMA identification number shall be stamped on manufacturer’s motor nameplate.

16. Motor lubrication system shall consist of a sealed bearing or a grease inlet on motor bracket with capped grease fitting on inlet, grease relief plug 180 degrees from inlet, grease reservoir in bracket and grease reservoir in cast inner cap. Motor shall be greased by manufacturer with a premium moisture resistant polyuria thickened grease containing rust inhibitors and suitable for operation over temperatures from -25° C to 120° C.
17. All bolt and cap screws shall be of high strength, SAE Grade 5 zinc-plated and chromatic steel. Screwdriver slot fasteners are unacceptable.

18. All motor parts including frame, brackets, fan cover and terminal box shall receive a minimum of two coats of high grade USDA accepted epoxy paint. Motor assembly shall successfully withstand salt spray tests for corrosion in accordance with ASTM B-117 for 96 hours.

19. All motors shall be painted the same color as the driven equipment.

20. Two-speed motors shall be two-winding motors. Two-speed, one-winding consequential-pole motors that require special motor starters are prohibited.

2.3 MOTORS LESS THAN 1/2 HORSEPOWER

A. General:
1. Unless otherwise specified, motors less than 1/2 horsepower shall be squirrel cage, single phase, capacitor start, induction run type. Construction features listed in Paragraph 2.2, above, shall be as normally supplied by the equipment manufacturer. Single phase motors shall have Class B insulation, minimum. Small fan motors may be split-phase or shaded pole type. Windings shall be copper.

B. Rating:
1. Unless otherwise specified, motors shall be rated for operation at 115 volts, single phase, 60 Hz, and shall be continuous-time rated in conformance with NEMA Standard MG 1, Paragraph 10.35. Dual voltage (115/230) rated motors are acceptable if all leads are brought out to the conduit box. Motors shall be non-overloading at all points of the equipment operation.

C. Enclosures:
1. Unless otherwise specified, motors shall have totally enclosed fan cooled or totally enclosed non-ventilated enclosures.

2.4 MOTORS 1/2 HORSEPOWER THROUGH 250 HORSEPOWER

A. General:
1. Unless otherwise specified, motors 1/2 horsepower through 250 horsepower shall be three phase, squirrel cage, full voltage start induction type. Unless otherwise specified, motors shall have a NEMA MG 1-1.16 design letter B or C torque characteristic as required by the driven equipment’s starting torque requirements.

B. Rating:
1. Unless otherwise specified, motors shall be rated for operation at 460 volts, 3 phase, 60 Hz, and shall be continuous time rated in accordance with NEMA Standard MG 1, Paragraph 10.35.

2. Motors for variable frequency systems shall not be required to deliver more than 80 percent of the motor’s service factor rating by any load imposed by the driven machine at any specified operating condition or any condition imposed by the driven machine’s performance curve at maximum operating speed.

C. Enclosure and Insulation:
1. General: Motors shall be classified as Type 1 (Process) and Type 2 (Explosion proof). Enclosures and insulation systems shall be as specified in the following paragraphs. Temperature rise for all motor types shall not exceed that permitted by Note II, Paragraph 12.42, NEMA MG 1. The insulation shall be non-hygroscopic.
   a. Type 1 Motors (Process): Type 1 motors shall be premium energy efficient motors, totally enclosed, fan cooled. All motors shall have Class H insulation with Class B temperature rise. Motors shall conform to IEEE 841. All internal surfaces shall be coated with an epoxy paint. Motors shall be rated for corrosive atmosphere duty.
   b. Type 2 Motors (Explosion proof): Explosion proof motors shall be UL listed in accordance with UL 674 for Class I, Group D hazardous atmospheres. The motor shall have Class H insulation and shall conform to IEEE 841. Steel frame motors will not be permitted. A UL-approved Type 316 stainless steel breather/drain device shall be provided in the motor drain hole. The motor shall be provided with a frame temperature thermostat which meets the UL frame temperature limit code T2A (280°C). The thermostat shall contain an automatically reset, normally closed contact rated two amperes at 115 volts AC.

D. Motors for Variable Frequency Drives:
1. Motors intended for use with variable frequency drives shall be compatible with the characteristics of the intended variable frequency inverters. Motors shall be Type 1 or Type 2 as specified in the detailed Specification. Insulation for all motors operating with variable frequency drives shall be Class H with Class B temperature rise. Variable frequency drive motors shall be premium energy-efficient motors. Motors shall be capable of withstanding a pulse voltage of at least 1750 volts with a rate of rise up to 750V/micro second. The motors shall be certified by the manufacturer as suitable for inverter duty.

E. Minimum Manufacturer’s Nameplate Efficiency: Motor minimum manufacturer’s nameplate efficiency, determined in accordance with IEEE
112B testing procedures, when operating on a sinusoidal power source shall conform to the following:

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<table>
<thead>
<tr>
<th>HORSEPOWER RANGE</th>
<th>SPEED, RPM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1200</td>
</tr>
<tr>
<td>1-2</td>
<td>82.5</td>
</tr>
<tr>
<td>3-5</td>
<td>89.5</td>
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<tr>
<td>7-25</td>
<td>90.2</td>
</tr>
<tr>
<td>30-60</td>
<td>92.4</td>
</tr>
<tr>
<td>75-250</td>
<td>94.1</td>
</tr>
</tbody>
</table>

F. Vertical Motors:
1. Unless otherwise specified, vertical motors shall be full voltage with a Type P base specifically designed for vertical installation. Universal position motors are not acceptable. Vertical motors shall have solid shafts, unless otherwise specified. Vertical motors shall conform to either Type 1 or Type 2 motor requirements as specified under Paragraph 2.4.C., above. Thrust bearing rating shall be compatible with the loads imposed by the driven equipment.

G. Conduit Boxes:
1. CAUTION: External conduit boxes on motors shall be sized to accommodate oversized feeder conductors and as shown on the Drawings shall, in any case, not be less than one size larger than NEMA standards. The conduit boxes shall be diagonally split and rotatable in 90 degree steps. A gasket shall be furnished between the conduit box and frame. Motor leads shall be stranded copper wire, Class H or better insulated, non-wicking, with permanent identifications spaced 1-1/2-inches maximum. Clamp type grounding terminals shall be provided in the conduit boxes.
H. Lifting Eyes:
   1. Motors weighing more than 50 pounds shall be fitted with at least one lifting eye.

I. Current Imbalance:
   1. Current imbalance shall not exceed the values tabulated below when the motor is operating at any load within its service factor rating and is supplied by a balanced voltage system.
      a. Under five horsepower: Ten percent
      b. Five horsepower and above: Ten percent
   2. Imbalance criteria shall be based upon the lowest value measured.

2.5 PRODUCT DATA

A. The following information shall be provided for each motor in accordance with the individual equipment specification.
   1. Motor outline, dimensions and weight.
   2. Manufacturer’s general descriptive information relative to motor features.
   3. Where a winding overtemperature device is required, provide a response curve for the temperature device.
   4. Applicable operation and maintenance information specified in Section 01781, Operation and Maintenance Data. Provided overhaul instructions for each motor five HP and over.

2.6 ACCEPTABLE PRODUCTS

A. The following manufacturer’s motors generally meet the class and performance requirements of this specification when furnished with appropriate modifications and additional features as specified:
   1. General Electric Inc.
   2. Emerson US Motors
   3. Siemens

PART 3 - EXECUTION

3.1 GROUNDING AND BONDING

A. Verify the circuit ground cable (green) is identified and connected to the grounding lug terminal in the conduit box.

B. Provide supplementary grounding by installing a bond from the motor frame to the grounding electrode system as indicated on the drawings.
3.2 FIELD TESTING

A. Verify breather/drain fittings have been installed as specified herein.

B. Provide winding insulation resistance testing for motors to be witnessed by owner or engineer before connection is complete. Winding insulation resistance shall be not less than 10-megohm measured with a 1000-VAC megohmmeter at 1-minute at or corrected to 40-degree C.

C. Provide motor phases current imbalance testing to be witnessed by owner or engineer.

+ + END OF SECTION + +
SECTION 11287

STAINLESS STEEL SLIDE GATES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required to furnish and install stainless steel slide gates and appurtenances.
   2. Included are stainless steel slide gates, anchorage systems and all appurtenances.
   3. Extent of the equipment on the Stainless Steel Slide Gate Schedule contained in Part 2 of this Section.

1.2 QUALITY ASSURANCE

A. Manufacturer’s Qualifications:
   1. Manufacturer shall have a minimum of five years of experience of producing substantially similar equipment and shall be able to show evidence of at least five installations in satisfactory operation for at least five years.
   2. Stainless steel slide gates shall be the product of one manufacturer.

B. Unit Responsibility:
   1. Unit Responsibility shall be assigned by CONTRACTOR as specified in Section 01600, General Equipment Provisions, to the individual gate suppliers for the entire gate assembly.

C. Component Supply and Compatibility:
   1. Obtain all equipment included in this Section regardless of the component manufacturer from a single stainless steel slide gate equipment manufacturer.
   2. Stainless steel slide gate equipment manufacturer shall review and approve or shall prepare all Shop Drawings and other submittals for all components furnished under this Section.
   3. All components shall be specifically designed for control of decant service and shall be integrated into the overall equipment design by the stainless steel slide gate equipment manufacturer.

D. Source Quality Control:
   1. Shop Tests:
      a. Test each stainless steel slide gate fully assembled in the vertical position for proper seating.
b. Fully open and close gate disc in its guide system to ensure that it operates freely.
c. Operate and test floor stands and bench stands to ensure proper assembly and operation.

E. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
1. ASTM A 276, Specification for Stainless Steel Bars and Shapes.

1.3 SUBMITTALS

A. Certificate of Unit Responsibility attesting that CONTRACTOR has assigned, and the supplier accepts unit responsibility in accordance with the requirements of this Section and Section 01600, General Equipment Provisions. No other Submittal material will be reviewed until the certificate has been received and conforms to the specified requirements.

B. Shop Drawings: Submit for approval the following:
1. Comply with the requirements of Section 01332, Shop Drawing Procedures.
2. Fabrication, assembly and installation diagrams.
3. Manufacturer’s literature, illustrations, specifications and engineering data.
4. Setting drawings, templates, and directions for the installation of anchor bolts and other anchorages.
5. Wiring diagrams for electric motor operators.

C. Shop Test Results:
1. Submit results of the required shop tests.

D. Field Test Results:
1. Submit a written report giving the results of the field tests required.

E. Operation and Maintenance Manuals:
1. Submit complete installation, operation and maintenance manuals including, test reports, maintenance data and schedules, description of operation and spare parts information.
2. Furnish Operation and Maintenance Manuals in conformance with the requirements of Section 01781, Operation and Maintenance Data.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the site to ensure uninterrupted progress of the Work. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete in ample time to not delay the Work.
B. Handle all stainless steel slide gates and appurtenances properly, in accordance with manufacturer’s recommendations. Stainless steel slide gates which are distorted or otherwise damaged will not be acceptable. Protect all bolt threads and ends from damage and corrosion.

C. Store materials to permit easy access for inspection and identification. Keep stainless steel members off the ground using pallets, platforms or other supports. Protect stainless steel members and packaged materials from corrosion and deterioration.

D. Store all mechanical equipment in covered storage off the ground, and prevent condensation.

PART 2 - PRODUCTS

2.1 SERVICE CONDITIONS

A. General: Design equipment to be suitable for the process and service conditions described below and in the Stainless Steel Slide Gate Schedule.
   1. Design stainless steel slide gates to safely withstand conditions listed in the Stainless Steel Slide Gate Schedule.
   2. Stainless steel slide gates shall be substantially watertight with leakage less than 0.5 gpm per foot of seating perimeter at design head.
   3. Manual operators shall turn right to close, unless otherwise specified. Operators shall indicate the direction of operation.
   4. Bolts, studs, cap screws, and adjusting screws shall be of ample section to withstand the force created by operation of the gate under a full head of water.
   5. Downward opening stainless steel slide gates shall be capable of being lowered to an elevation below the invert of the channel or opening.
   6. Stainless steel slide gates shall open to not less than 6-inches above the maximum water level in the channel in which they are installed.

2.2 FABRICATION

A. Materials of Construction:
   1. Stainless Steel: For frame, slide, rail and yoke, ASTM A 276, Type 316 stainless steel. All metal for stainless steel slide gate parts shall have a minimum thickness of 1/4-inch.
   2. Bronze Casting: For operating nut, thrust nut and lift nut; ASTM B 584 Alloy 865.
   3. All bolts, studs, cap screws and adjusting screws shall be of Type 316 stainless steel.
   4. Bolts and nuts shall have hexagon heads.
5. Gasket material and installation shall conform to manufacturer’s recommendations.

B. Disc:
   1. Fabricate the slide or disc of ASTM A 276, Type 316 stainless steel plate reinforced with structural shapes attached by welding.
   2. Provide reinforcing to limit deflection under full head to not more than 1/360 of the span.
   3. Extend reinforcing ribs into the guides overlapping the seating surface of the guide.
   4. Weld stem mounting guides to the disc.

C. Disc Guides:
   1. Guides shall be of Type 316 stainless steel incorporating a sandwich type construction using plates and structural angles.
   2. Guides shall be designed for maximum rigidity as columns to take the thrust developed during the stainless steel slide gate operation under maximum head.
   3. Guides shall extend beneath the opening a sufficient amount to support the disc in the fully open or closed position.

D. Stem:
   1. Operating stems shall be of Type 316 stainless steel and designed as specified below.
   2. Design stem to transmit in compression at least 2-1/2 times the rated output of the operating mechanism with a 80 pound effort on the crank or handwheel. Determine the critical buckling load using the Euler column formula, using C = 2. Where hydraulic cylinder lifts are used, the stem design force shall not be less than 1.25 times the output thrust of the hydraulic cylinder with a pressure equal to the maximum working pressure of the hydraulic fluid supply. Where electric motor driven lifts are used the stem design force shall not be less than 1.25 times the output thrust of the unit in the stalled motor condition.
   3. Stems shall have a slenderness ratio (L/R) less than 200.
   4. Threaded portion of the stem shall have machined cut threads of the Acme type. Join stems of more than one section by stainless steel couplings threaded and keyed, or bored and pinned to the stems. All threaded and keyed couplings of the same size shall be interchangeable. Provide rising stems with an adjustable stop collar on the stem.
   5. Connect the stem to the disc by means of a bolted connection.

E. Yoke (For Self Contained Type Gates):
   1. Furnish tops of the extended guides with a yoke for mounting of the lifting device.
   2. Construct the yoke of structural shapes of sufficient strength to take the full thrust created by operating the gate under the maximum specified head.
3. Attach the yoke to the framework by bolting or welding so as to permit removal of the gate slide and stem.

F. Lower Seals:
1. Mount a specially shaped resilient neoprene seal on the bottom of the disc to provide flush-bottom closure for stainless steel slide gates. As an alternate, a poured urethane seal shall be mounted in the invert of the frame to form a flush bottom seal.
2. Shape of the seal shall produce a seating surface having a minimum width of 3/4-inch, and the seal will extend beyond the seating surface of the frame.
3. Vertical face of the seal shall be in contact with the seating surface of the guide to provide a proper seal at the corners.

G. Side and Upper Seals:
1. Side and upper seals shall be fabricated from ultra high molecular weight (UHMW) polyethylene or UHMW polymer. UHMW bearing strips shall be mechanically retained to lock seat in place.

H. Packing Glands:
1. Provide downward opening stainless steel slide gates in covered tanks with a suitable packing gland to prevent the escape of air from the tanks through the stem sleeve.

I. Product and Manufacturer: Provide one of the following:
1. Rodney Hunt Company.
2. Waterman Industries.
3. H. Fontaine Ltd.

2.3 APPURTENANCES

A. Stem Guides:
1. Guides shall be adjustable in two directions and shall be spaced so that stems have a maximum unsupported length of 84-inches.
2. Anchor bolts for stem guides shall be Type 316 stainless steel.

B. Anchor Bolts:
1. Provide Type 316 stainless steel anchor bolts as required for stem guides, floorstands, and all equipment or appurtenances which must be secured to concrete walls or floors. Anchor bolts shall be of ample size and strength for the purpose intended, and shall be furnished by the manufacturer. Anchor bolts shall be hooked, and provided for direct embedment during placement of concrete. Anchor bolts shall conform to the requirements of Section 05051, Anchor Bolts, Toggle Bolts and Concrete Inserts.

C. Stem Cover:
1. Furnish all stems with a clear polycarbonate or butyrate plastic pipe stem cover. Covers shall be furnished with a cast aluminum adaptor for mounting covers to floor stands. Stem covers shall be designed and furnished with gasketing and breathers to eliminate water intrusion into operators and condensation within the covers.

2. Engrave the covers with legible markings showing as a minimum the gate position at 1/4 open, 1/2 open, 3/4 open and full open.

D. Manual Operators:
1. Manual operation shall be by handwheel or crank operated floorstand or benchstand as shown on the Drawings and specified.
2. Handwheel-operated type shall be without gear reduction and crank-operated type will have either a single or double gear reduction, as required. Each type shall be provided with a threaded cast manganese bronze lift nut to engage the operating stem.
3. Provide anti-friction bearings to properly support both opening and closing thrusts.
4. Stands shall operate the gates under the specified operating head with not greater than a 40-pound pull on the crank or handwheel.
5. All components shall be totally enclosed in a cast iron weather-proof housing. Provide positive mechanical seals to exclude moisture and dirt and prevent leakage of lubricant out of the unit.
6. Provide lubricating fittings for all gears and bearings.
7. Stands shall include a cast iron pedestal designed to position the input shaft approximately 36-inches above the operating floor. An arrow with the word “OPEN” shall be permanently attached or cast on the floorstand indicating the direction of rotation to open the stainless steel slide gate.
8. Removable cranks shall be cast iron with a revolving brass grip. Removable handwheel shall be fabricated steel designed for rough treatment and minimum weight.
9. For self contained type stainless steel slide gates, the distance between handwheel or crank operator and the operating floor shall be 36-inches minimum and 48-inches maximum.
10. Crank-operated gates shall be provided with nut-operator drives as noted on Stainless Steel Slide Gate Schedule.
11. Operators shall be furnished with a limit switch to indicate fully closed position, where shown on the Drawings.
12. Provide mechanical stops adjustable ± five degrees at each end of travel.

E. Electric Operators:
1. Electric motor operators shall be furnished as shown on the Slide Gate Schedule, in accordance with the requirements of Section 11200, 480 Volt Motor-Operated Valve and Gate Actuators.
F. Identification: Identify each stainless steel slide gate with a stainless steel manufacturer’s nameplate stamped with the approved designation as shown in the Stainless Steel Slide Gate Schedule, below. Manufacturer’s nameplate shall be permanently fastened to the gate at the factory.

2.4 SURFACE PREPARATION AND PAINTING

A. Clean, prime coat, and finish coat ferrous metal surfaces of equipment in the shop in accordance with the requirements of Section 01600, General Equipment Provisions, and Section 09900, Painting.

B. Coat machined, polished and non-ferrous surfaces bearing surfaces and similar unpainted surfaces with corrosion prevention compound which shall be maintained during storage and until equipment begins operation.

C. Surface preparation and painting shall conform to Section 09900, Painting.

D. Certify, in writing, that the shop primer and coating system conforms to the requirements of Section 09900, Painting.

2.5 SPECIAL TOOLS

A. Furnish two sets of any special tools required for normal operation and maintenance.

2.6 LUBRICANTS

A. Furnish Food grade oil and grease meeting NSF 61 for water applications as required for initial operation. Use products recommended by the manufacturer.

2.7 SLIDE GATE SCHEDULE

A. Schedule 11287 “Stainless Steel Slide Gates” is the Stainless Steel Slide Gate Schedule. Conform to type, size, operation and other data specified, unless otherwise approved by ENGINEER.

B. Provide all stainless steel slide gates as shown on the Drawings and listed in the Stainless Steel Slide Gate Schedule.

C. Schedule Abbreviation:
   1. Type:
      a. EF - Embedded Frame.
      b. SM - Surface Mounted Frame.
c. WG - Downward Opening Weir Gate.

2. Operator Type:
   a. CO - Crank Operated.
   b. HW - Handwheel.
   c. EO - Electric Operated.

D. The seating and unseating design head as stated in the Stainless Steel Slide Gate Schedule is based on the head measured to the centerline of the gate in its closed position.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install stainless steel slide gate equipment in accordance with manufacturer’s instructions and recommendations.

B. Brace guides and frames during placement of concrete.

C. Set anchor bolts in accordance with approved Shop Drawings and manufacturer’s recommendations.

D. Provide minimum of 1-inch of non-shrink grout below all floorstands.

E. Adjust all parts and components as required to provide correct operation.

3.2 START-UP AND FIELD TESTS

A. After CONTRACTOR and ENGINEER have mutually agreed that the equipment installation is complete and ready for continuous operation, CONTRACTOR and a qualified field service representative of the manufacturer shall conduct a functional field test and a leakage test of each stainless steel slide gate in the presence of ENGINEER to demonstrate that each stainless steel slide gate furnished will function correctly and that maximum permissible leakage is not exceeded.

1. Functional Tests:
   a. Each stainless steel slide gate with appurtenances shall be field tested. Tests shall demonstrate to ENGINEER that each part and all parts together function in the manner intended. All necessary testing equipment and manpower shall be provided by CONTRACTOR at his expense. OWNER will furnish all power, and incidental material and labor required for the tests.

2. Leakage Tests:
   a. Maximum permissible leakage shall be in accordance with the requirements of Paragraph 2.1, above. Excess leakage shall be reduced to
meets specified requirements by adjusting the gate, or replacement will be required.

3. For electric operated gates, perform all field tests and adjustments required under Section 11200, 480 Volt Motor-Operated Valve and Gate Actuators.

4. In the event that the manufacturer is unable to demonstrate to ENGINEER that his equipment meets the requirements of the tests, the deficient equipment will be rejected; adjustments and/or modifications made and retest the equipment as often as necessary to meet the specified requirements. No separate payments shall be made for adjustments and/or modifications.

3.3 MANUFACTURER’S SERVICES (NOT USED)

(The remainder of this page was left blank intentionally.)
<table>
<thead>
<tr>
<th>Location: Sludge Solar Drying Bed 57 Decant Boxes</th>
<th>Sludge Solar Drying Bed 31 Decant Box (Additive Item A)</th>
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<tr>
<td>1. Designation</td>
<td>1. Designation</td>
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<tr>
<td>4. Type: SM</td>
<td>4. Type: SM</td>
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</tr>
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<td>b. Unseating: N/A</td>
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+ + END OF SECTION + +
SECTION 11318

END SUCTION SUBMERSIBLE PUMPS (DRY PIT INSTALLATION)

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
1. Provide all labor, materials, equipment and incidentals required to furnish and install three (3) submersible (dry pit installation), end suction centrifugal pumps complete and operational with motors, alarm equipment, alternator and accessories as shown on the Drawings and specified. Anchor bolts are included in this Section.

1.2 QUALITY ASSURANCE

A. Manufacturer’s Qualifications:
1. Manufacturer shall have a minimum of five years of experience of producing substantially similar equipment, and shall be able to show evidence of at least five installations in satisfactory operation for at least five years.

B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
3. City of Phoenix – Amendments to the National Electrical Code.
5. Institute of Electrical and Electronic Engineers.

C. Shop Tests:
1. Pump casings shall be hydrostatically tested to twice the discharge head or 1-1/2 times the shutoff head whichever is greater.
2. Running Test: Pump assembly shall be operated from zero to maximum capacity as shown on the approved curve. Results of the test shall be shown in a plot of test curves showing head, flow, horsepower, efficiency, and current. Readings shall be taken at a minimum of five evenly spaced capacity points including shut-off, design point and minimum head for which pump is designed to operate.
3. Each test shall be witnessed by a Registered Professional Engineer, who may be an employee of the manufacturer. The Registered Professional Engineer shall sign and seal all copies of curves and shall certify that hydrostatic tests were...
performed. Tests shall be conducted in conformance with the methods described in Section A6 of AWWA E101.

4. Pumps shall not be shipped until the ENGINEER has approved the test reports.

D. Unit Responsibility: Assign Unit Responsibility as specified in Section 01600, General Equipment Provisions, to the manufacturer or supplier for the equipment specified in this Section. A Certificate of Unit Responsibility shall be provided.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval the following:
   1. Manufacturer’s literature, illustrations, specifications and engineering data including: dimensions, materials, size, weight, performance data and pump curves showing overall pump efficiencies, flow rate, head, brake horsepower, motor horsepower, speed and shut-off head.
   2. Shop Drawings Showing: Fabrication, assembly, installation and wiring diagrams.
   4. Motor tests and data as described in PART 2 below.
   5. Submit Shop Test results conforming to Paragraph 1.2.C., above.

B. Operation and Maintenance Manuals:
   1. Submit complete installation, operation and maintenance manuals including test reports, maintenance data and schedules, pump curves, description of operation and spare parts information.
   2. Furnish operation and maintenance manuals in conformance with the requirements of Section 01781, Operation and Maintenance Data.

PART 2 - PRODUCTS

2.1 SERVICE CONDITIONS

A. Pumps shall be submersible end suction centrifugal dry pit installation type. Pumps shall be designed for operation under complete submersion, partial submersion and also under dry conditions. Each pump shall be specially designed, constructed, and installed for the service intended and shall comply with the design conditions listed below.

(The remainder of this page was left blank intentionally.)
B. Design Conditions:

<table>
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<tr>
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<td>Use:</td>
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<tr>
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<td>Flow at 2nd Design Point: gpm</td>
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<td>1000</td>
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<td>TH at 2nd Design Point: ft.</td>
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<td>37</td>
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<tr>
<td>Flow at 3rd Design Point: gpm</td>
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<td>800</td>
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<tr>
<td>TH at 3rd Design Point: ft</td>
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### SYSTEM CURVE TABLE

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</table>

### 2.2 DETAILS OF CONSTRUCTION

#### A. Pump Materials and Construction:

1. Stator casing, oil casing, sliding bracket, volute and impeller shall be close grained grey cast iron.
2. Impeller shall be enclosed single vane non-clog, dynamically balanced. Wear ring shall be stainless steel.
3. External Hardware: All bolts, nuts and cap screws shall have hexagon heads and be of stainless steel.
5. The seal shall require neither maintenance nor adjustment and shall be easily replaceable. Shaft seal shall be mechanical type.
6. Bearings: Anti-friction, grease or oil lubricated with a minimum B-10 life of 100,000 hours.
7. Stainless steel manufacturer’s nameplate giving the model and serial number, rated capacity, head, speed and all other pertinent data shall be attached to the pump.

#### B. Motors:

1. Motors shall conform to the requirements of Section 11000, Electric Motors.
2. Motors shall be solid shaft of stainless steel, ball bearing type. Motor casing shall be air-filled and watertight with moisture resistant Class F 155°C insulation. Power shall be 460 Volts, 60 Hz, and 3 phase.
3. Cable entry shall be isolated with an internal terminal board.
4. Pump and motor shall be designed for continuous and intermittent operation up to twelve starts per hour in a non-submerged condition without damage.
5. Motors shall be non-overloading for the entire pump operating curve.
6. Cable and sizing shall conform to Phoenix Electrical Code for pump motors and shall be supplied in sufficient length to extend continuously, without splices,
from the pump to the pump control panel. The power cable entry assembly shall be stainless steel and shall be provided with a strain relief element to inhibit leakage in the event the cable is pulled. Motor power cords shall meet the requirements of the Mine Safety and Health Administration for trailing cables. Motor power cords shall be suitable for direct burial.

7. Motor thrust bearings shall be designed for continuous thrust loads under all conditions of pump operation from zero head to shut-off. The anti-friction bearings shall be rated for a B-10 life of 100,000 hours.

8. Motor Sensors:
   a. Each pump motor shall be equipped with a minimum of three thermal sensors embedded in the stator windings and wired to the control panel for supplemental motor protection.
   b. Leakage sensor in lower part of stator housing shall be wired to leads in the junction chamber.

9. Motors shall have built-in thermal overload protection.

10. Motor Tests and Data:
    a. For each motor furnish an inspection report for the motor or for a previously manufactured electrically duplicate motor which was tested. Provide the following minimum data:
       1) Running current.
       2) Locked rotor current.
       3) Winding resistance measurement.
       4) High potential test.
       5) Bearing inspection.

C. Accessory Equipment:
   1. Provide the following accessories for each pump as required for a complete installation.
      a. Anchor Bolts: Type 316 stainless steel.

D. Monitoring Equipment:
   1. General:
      a. Provide power and control cables and motor protective control devices as specified in Paragraph 2.2.B., above, and in Paragraph 2.2.D.2., below.
      b. Instrumentation and control system operational functional requirements relative to the pump applications are shown on the Drawings and specified in applicable Sections in Division 17000.
   2. Motor Protective Control Devices:
      a. For each pump motor assembly:
         1) Provide a solid state monitoring relay with SPDT dry contact closure control outputs for:
            a) Stator winding overtemperature.
            b) Stator housing leakage sensor.
         2) Relays shall be mounted in control panel by others.
F. Product and Manufacturer: Provide one of the following:
   1. Flygt Corporation, Model NZ 3085 MT 3~ 462 (Pumps 5 and 6)
   2. Flygt Corporation, Model NZ 3153 MT 3~ 436 (Pump 7)
   3. Approved Equal.

2.4 SPARE PARTS

   A. Each pump shall be furnished with a manufacturer’s repair kit that shall include as a minimum the following:
      1. One set of mechanical seals for each pump.

   B. Spare parts shall be packed in sturdy containers with clear indelible identification markings and shall be stored in a dry, warm location until transferred to the OWNER at the conclusion of the Project. Comply with the requirements of Section 01783, Spare Parts and Maintenance Materials.

2.5 SURFACE PREPARATION AND PAINTING

   A. Pumps, motors, drives, frames, baseplates, appurtenances, etc., shall receive shop primer and shop finish coating conforming to the requirements of Section 09900, Painting. If any damage to the paint system occurs, the equipment shall be repainted as directed by the ENGINEER.

   B. Surface preparation and painting shall conform to the requirements of Section 09900, Painting.

   C. All gears, bearing surfaces, machined surfaces and other surfaces which are to remain unpainted shall receive a heavy application of grease or other rust-resistant coating. This coating shall be maintained during storage and until the equipment is placed into operation.

   D. Certify, in writing, that the shop primer and shop coating system conforms to the requirements of Section 09900, Painting.

PART 3 - EXECUTION

3.1 INSPECTION

   A. Inspect all equipment immediately upon delivery to site. If damaged, notify ENGINEER and manufacturer immediately.

   B. Make adjustments required to place system in proper operating condition. Do not install damaged equipment until repairs are made in accordance with manufacturer’s
written instructions and approved by the ENGINEER. Only minor repair work shall be permitted in the field. All other damaged items shall be sent to factory for repair or replacement.

3.2 START-UP AND TEST

A. Manufacturer’s representative shall check and approve the installation before operation. Manufacturer’s representative shall field test and calibrate the equipment to assure that the system operates to the OWNER’S satisfaction.

B. Make adjustments required to place system in proper operating condition. Field test and calibrate the equipment to assure that the system operates in accordance with these Specifications and to the satisfaction of the ENGINEER.

C. After completion of installation, the system shall be completely tested to ensure compliance with the operating requirements as specified, indicated on the Drawings and in accordance with Section 01752, Equipment and System Startup and Performance Testing.

D. All equipment will be given running tests by CONTRACTOR at the job site following installation of the equipment and controls. Should the tests indicate any malfunction, make any necessary repairs and/or adjustments. Such tests and adjustments shall be repeated until, in the opinion of the ENGINEER, the installation is complete and the equipment is functioning properly and accurately, and is ready for permanent operation.

3.3 MANUFACTURER’S SERVICES

A. A factory trained representative shall be provided for installation supervision, start-up and test services and operation and maintenance personnel training services. The representative shall make a minimum of three (3) visits, minimum two (2) hours on-site for each visit, to the site. The first visit shall be for assistance in the installation of equipment. The second visit shall be for checking the completed installation and start-up of the system. The third visit shall be as described under Section 01821, Instruction of Operations and Maintenance Personnel. Manufacturer’s representative shall test operate the system in the presence of the ENGINEER and verify that the pumps conform to requirements. Manufacturer’s representative shall revisit the job site as often as necessary until all trouble is corrected and the installation is entirely satisfactory.

B. All costs, including travel, lodging, meals and incidentals, shall be considered as included in CONTRACTOR’S bid price.
CITY OF PHOENIX: Water Services Department
PROJECT NAME: 91st Avenue WWTP Sludge Solar Drying Beds
PROJECT NUMBER: WS90100098

++ END OF SECTION ++

91st Avenue WWTP Sludge
Solar Drying Beds 11318-8 06/09/17
SECTION 15112

ECCENTRIC PLUG VALVES, OPERATORS AND APPURTENANCES

PART I - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment and incidentals required to furnish and install all eccentric plug valves, operators and appurtenances complete and operational as shown on the Drawings and as specified.
   2. The Work includes, but is not necessarily limited to, all valves required for buried, exposed, submerged and other types of piping, except where otherwise specifically included in other Sections.

B. Coordination:
   1. Review installation procedures under other Sections and coordinate with the Work which is related to this Section including buried piping installation, exposed piping installation and site utilities.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications:
   1. Manufacturer shall have a minimum of five years experience of producing substantially similar equipment, and shall be able to show evidence of at least five installations in satisfactory operation for at least five years.
   2. Each eccentric plug valve shall be the product of one manufacturer.

B. Unit Responsibility:
   1. Unit Responsibility shall be assigned by CONTRACTOR as specified in Section 01600, General Equipment Provisions, to the individual gate suppliers for the entire gate assembly. A Certificate of Unit Responsibility shall be provided.

C. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
   1. ANSI B16.1, Cast Iron Pipe Flanges and Flanged Fittings.
   2. ANSI B16.4, Cast Iron Fittings.
   4. ASTM B 62, Specification for Composition Bronze or Ounce Metal Castings.
   6. ASTM A 307, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
11. ASTM A 2472, Specification for Nickel-Copper Alloy Plate, Sheet and Strip.
12. ASTM B 98/B 98M, Specification for Copper-Silicon Alloy Rod, Bar and Shapes.
15. AGMA Standards.
16. NEMA, National Electrical Manufacturer's Association.
18. City of Phoenix – Amendments to the National Electrical Code.

1.3 SUBMITTALS

A. Certificate of Unit Responsibility attesting that CONTRACTOR has assigned, and the supplier accepts unit responsibility in accordance with the requirements of this Section and Section 01600, General Equipment Provisions. No other Submittal material will be reviewed until the certificate has been received and conforms to the specified requirements.

B. Shop Drawings: Submit for approval the following:
1. Comply with the requirements of Section 01332, Shop Drawing Procedures.
2. Manufacturer's literature, illustrations, paint certifications, specifications, detailed drawings, data and descriptive literature on all eccentric plug valves and appurtenances.
3. Deviations from Contract Documents
4. Engineering data including dimensions, materials, size and weight.
5. Fabrication, assembly and installation drawings.
6. Certificates of compliance with AWWA Standards, where applicable.
7. Corrosion resistance information to confirm suitability of the eccentric plug valve materials for the application. Information on chemical resistance of elastomers shall be furnished from the elastomer manufacturers.
8. Complete manufacturer’s nameplate data of eccentric plug valves.
9. Special tools list.
10. Cv values and headloss curves.
11. Calculations:
   a. Sizing of operating mechanism with extension stems.
   b. Sizing of gear actuators.
   c. Sizing of anchor bolts.

C. Operation and Maintenance Manuals:

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1. Submit complete installation, operation and maintenance manuals including test reports, maintenance data and schedules, description of operation and spare parts information.

2. Furnish Operation and Maintenance Manuals in conformance with the requirements of Section 01781, Operation and Maintenance Data.

D. Shop Tests:
   1. Test motor operated eccentric plug valves before shipment to ensure that the mechanisms can close the valves in the specified time limit, and for proper seating.
   2. Hydrostatic tests shall be performed, when required by the valve specifications included herein.

E. Certificates: Where specified or otherwise required by ENGINEER, submit test certificates.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the site to ensure uninterrupted progress of the Work.
   1. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete, in ample time to not delay the Work.

B. Handle all eccentric plug valves and appurtenances very carefully. Eccentric plug valves which are cracked, dented or otherwise damaged or dropped will not be acceptable.

C. Store materials to permit easy access for inspection and identification. Keep steel members off the ground, using pallets, platforms or other supports. Protect steel members and packaged materials from corrosion and deterioration.

D. Store all mechanical equipment in covered storage off the ground and prevent condensation and in accordance with the manufacturer's recommendations for long term storage.

PART 2- PRODUCTS

2.1 MATERIALS

A. General:
   1. Eccentric plug valves shall have manufacturer's name and working pressure cast in raised letters on valve body.
   2. Manual eccentric plug valve operators shall turn clockwise to close, unless otherwise specified. Valves shall indicate the direction of operation.
3. Manually operated eccentric plug valves, with or without extension stems, shall require not more than a 40-pound pull on the manual operator to open or close a valve against the specified criteria. The gear actuator and the eccentric plug valve components shall be able to withstand a minimum pull of 200-pounds on the manual operator and an input torque of 300-foot pounds to an actuator nut. Manual operators include handwheel, chain, crank, lever and a T-handle wrench.

4. Unless otherwise specified, all flanged eccentric plug valves shall have ends conforming to ANSI B16.1. The pressure class of the flanges shall be equal to or greater than the specified pressure rating of the valves.

5. Buried eccentric plug valves shall have flanged ends with mechanical joint adapters and installed with a flanged adapter or have grooved mechanical couplings. All bolts shall be Type 316 stainless steel.

6. Buried eccentric plug valves shall be provided with adjustable two piece valve boxes and provided with extension stems, operating nuts and covers, unless otherwise shown on the Drawings or specified. Extension stems shall terminate 12-inches below finished grade.

7. All bolts, nuts and studs on or required to connect buried or submerged valves shall be Type 316 stainless steel.

8. All bolts and studs embedded in concrete and studs required for wall pipe shall be of Type 316 stainless steel.

9. For stainless steel bolting, except where Nitronic-60 nuts are required, use anti-seize compound, graphite free, to prevent galling. Strength of the joint shall not be affected by the use of anti-seize compound.

10. All other bolts, nuts and studs shall, unless otherwise approved, conform to ASTM A 307, Grade B; or ASTM A 354.

11. Bolts and nuts shall have hexagon heads and nuts.

12. All materials of construction of the eccentric plug valves shall be suitable for the service as shown on the Drawings.

13. Protect wetted parts from galvanic corrosion due to contact of two different metals.

14. Gasket material and installation shall conform to manufacturer's recommendations.

15. Identification: Identify each eccentric plug valve 4-inches and larger with a stainless steel manufacturer’s nameplate stamped with the approved designation. Manufacturer’s nameplate shall be permanently fastened to valve body at the factory. Stenciled designations are acceptable for buried valves.

16. All eccentric plug valves for digester gas service shall be suitable for gas having the following composition by percent volume and other characteristics:
   a. Methane: 60 to 70 percent.
   b. Carbon Dioxide: 30 to 35 percent.
   c. Nitrogen: 0 to 50 percent.
   d. Hydrogen Sulfide: 0 to 0.2 percent.
   e. Gas Temperature: 0° to 140°F.
   f. Relative Humidity: 100 percent.
17. Buried or submerged service eccentric plug valves shall be provided with greased filled actuators with position indicators.

B. Eccentric Plug Valves:
   1. General:
      a. Non-lubricated eccentric type plug valves shall be installed where flow through the valve will be in only one direction.
      b. Eccentric plug valve shall have flanged ends. Flanges shall be faced and drilled to ANSI B16.1, Class 125.
   2. Eccentric Plug Valves:
      a. Valves shall have a valve port area of a minimum 80 percent of the full pipe area. Special application eccentric plug valves shall be provided with a port area of 100 percent of full pipe area as shown on the Drawings.
      b. Valves shall be rated for a minimum working pressure of 150 psig.
      c. Exposed valve flanges shall be faced and drilled in accordance with ANSI B16.1, Class 125. Buried valves shall be provided with flange ends with mechanical joint adapters.
      d. Valve bodies shall be of cast iron conforming to ASTM A 126, Class B. Valve seats shall be of welded-in 90 percent nickel alloy, or Monel, a minimum of 1/8-inch thick conforming to ASTM B 127.
      e. Valves shall be furnished with replaceable stainless steel sleeve-type bearings in the upper and lower journals. These bearings shall comply with the applicable sections of AWWA C507 and AWWA C504. Bearings shall be of sintered, oil impregnated permanently lubricated Type 316 stainless steel for valves 12-inch and smaller. Bearings shall be ASTM A 743/A 743M Grade CF-8M, ANSI Type 316 stainless steel for Teflon coated Type 316 stainless steel for valves 14-inches and larger.
      f. Shaft seals shall be of the multiple V-ring type, externally adjustable, replaceable without removing the bonnet or actuator from the valve, repackable under pressure and shall comply with the applicable sections of AWWA C504 and AWWA C507. Packing shall be adjustable chevron type replaceable without disassembling the valve for aboveground valves. Buried or submerged service valves shall have a self adjusting, multi-V-ring type packing in a suitable sealed enclosure.
      g. Eccentric plug valves for liquid service shall have a balanced plug coated with a vulcanized resilient isobutene-isoprene solidly bonded to a semi-steel core, as required, to assure low torque and drip-tight shutoff, suitable for bi-directional shutoff, with sewage, grit, sludge, potable and non-potable water operating at a temperature of 250°F.
      h. Eccentric plug valves for digester gas and centrate/decant service shall be provided with drilled, tapped and plugged taps (1/8-inch P.T.F. SAE thread) in the upper and lower journal of 4-inch through 12-inch sizes, and provide gas service nitrile-butadiene plug facings on a Type 316 stainless steel plug and gear actuators designed for 50 psi minimum line pressure.
Digester gas service valves 4-inch and larger shall have worm gear operators.

i. Products and Manufacturers: Provide one of the following:
   1) DeZurik Corporation.
   2) Val-Matic Valve & Mfg. Corp.

3. All Eccentric Plug Valves:
   a. All valves 6-inches in diameter and larger and all manually operated eccentric plug valves installed more than five feet above the operating floor regardless of size, shall be equipped with a geared operator.
   b. Manually operated valves smaller than 6-inches diameter installed five feet or less above the operating floor shall be lever wrench operated.
   c. Size gear actuators for valves 8-inch and smaller for 175 psig differential pressure.
   d. Size gear actuators for valves larger than 8-inch for the following maximum differential pressures:
      1) Maximum Differential Pressure Across Closed Valve: 100 psi.
   e. Design the actuators to hold the valves in any intermediate position without creeping or vibrating.
   f. Provide a valve position indicator on each actuator. Provide stop-limiting devices for open and closed position.
   g. Provide an adjustable stop to adjust the seating pressure.
   h. Make packing accessible for adjustment without requiring the removal of actuator from the valve.
   i. The diameter ratio of the handwheel or the chainwheel and the gear sector shall be less than two.
   j. For buried or submerged valves, the gear actuator shall be grease-packed and designed to withstand submersion and be driptight in water to 20 feet submergence.
   k. Provide each actuator with gearing totally enclosed.
   l. The operator shaft and the gear sector shall be supported on permanently lubricated bronze bearings.
   m. Provide metal encased spring loaded seals in top and bottom covers of the gear housing.
   n. Actuators shall be designed to produce the indicated torque with a maximum pull of 40-pounds on the handwheel or chainwheel and a maximum input of 150-foot pounds on operating nuts, both for seating and unseating heads equal to the maximum differential pressure.
   o. All actuator components between the input and the stops shall be designed to withstand, without damage, a pull of 200-pound for handwheel or chainwheel actuators and an input torque of 300-foot pound for operating nuts when operating against the stops.
   p. Materials of Construction:
      1) Housing: Cast Iron, ASTM A 126, Class B.
      2) Gear Sector: Ductile Iron, ASTM A 536.
3) Worm Gear: Steel, AISI 1144, hardened and tempered to an average Rc 40 and within range of Rc 35 to 45.
4) All Bearings: Bronze oil impregnated.
5) All Hardware including Bolts, Nuts, Washers, Set Screws and Pins: Type 316 stainless steel.

q. Valves higher than five feet above the operating floor:
   1) Chainwheels, sprockets and Type 304 stainless steel chain shall be provided for gear operated valves mounted more than five feet above the operating floor.
   2) Chain shall extend to three feet above the operating floor.
   3) Gearing shall be enclosed in a semi-steel housing and shall be suitable for running in a lubricant, with seals provided on all shafts to prevent entry of dirt and water into the operator.
   4) Operator shaft and the gear quadrant shall be supported on permanently lubricated stainless steel bearings.
   5) Operator shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque.
   6) Exposed nuts, bolts and washers shall be zinc plated.

r. Where lever wrench operated valves are required, each valve shall be furnished with its own lever wrench operator.

s. Extension Bonnets: Where required, extension bonnets shall be provided. Extension bonnet shall be of steel or cast iron, with carbon steel stems, constructed so that when connected to the valve the extension bonnet shall be vertical, and designed to fully support the operator and stem extension. Exposed extension stems shall be of Type 316 stainless steel. Intermediate bearings shall be provided on the extension bonnet, as required.

t. Valve packing adjustment on non-submerged valves shall be accessible without removing the actuator from the valve.

u. Shop Painting:
   1) Interior ferrous metal surfaces of the valve except finished or bearing surfaces and the plug, shall be shop painted with two coats of an approved two component coal tar epoxy coating applied in accordance with the manufacturer's recommendations.
   2) Exterior surfaces of the valve and operator shall be shop painted as specified hereinafter under Article 2.8, below.

4. Eccentric Plug Valves - Guarantee:

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ECCENTRIC PLUG VALVES - GUARANTEE

WHEREAS

of (Address)

, Telephone:

Herein called the "Valve Manufacturer" has furnished eccentric plug valves on the following Project:

City of Phoenix

OWNER: City of Phoenix

Guarantee Period: Five years Date of Final Acceptance: Date of Expiration:

AND WHEREAS the Valve Manufacturer has contracted (either directly with the OWNER or indirectly as a subcontractor) to Guarantee said Valves against leaks and faulty or defective materials and workmanship for the designated Guarantee Period;

NOW THEREFORE the Valve Manufacturer hereby Guarantees, subject to the terms and conditions herein set forth, that during the Guarantee Period he will at his own cost and expense, make or cause to be made such repairs to or replacements of said Valves as are necessary to correct faulty and defective work, and as are necessary to maintain said Valves to operate as specified.

This Guarantee is made subject to the following terms and conditions:

1. Specifically excluded from this Guarantee are damages to the Valves caused by: a) lightning, and other unusual phenomena of the elements; b) fire. When the Valves have been damaged by any of the foregoing causes, the Guarantee shall be null and void until such damage has been repaired by the Valve Manufacturer, and until the cost and expense thereof has been paid by the OWNER or by another responsible party so designated.

2. During the Guarantee Period if the OWNER allows alteration of the Valves by anyone other than the Valve Manufacturer, including maintenance in connection with other Work, this Guarantee shall become null and void upon the date of said alterations. If the OWNER engages CONTRACTOR to perform said alterations, the Guarantee shall not become null and void, unless the Valve Manufacturer, prior to proceeding with said Work shall have notified the OWNER, in writing, showing reasonable cause for claim that said alterations would likely damage or deteriorate the Valves, thereby reasonably justifying a termination of this Guarantee.

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3. The OWNER shall promptly notify the Valve Manufacturer of observed known or suspected, defects or deterioration, and shall afford reasonable opportunity for the Valve Manufacturer to inspect the valves, and to examine the evidence of such leaks, defects or deterioration.

4. This Guarantee is recognized to be the only Guarantee of the Valve Manufacturer on said Valves, and shall not operate to restrict or cut off the OWNER from other remedies and recourses lawfully available to him in cases of valves failures. Specifically, this Guarantee shall not operate to relieve the Valve Manufacturer of his responsibility for performance of the Valves, regardless of whether original contract was a contract directly with the OWNER or a subcontract with the OWNER’S CONTRACTOR.

IN WITNESS THEREOF, this instrument has been duly executed this __________ day of ___________________, 20__. 

Valve Manufacturer's Signature:

Typed Name:

As Its (position):

And has been countersigned by CONTRACTOR issuing the Valve Manufacturer's subcontract for said Valves:

Name of CONTRACTOR:

Date: Authorized Signature:

Typed Name:

As Its (position):

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2.2 ELECTRIC ACTUATORS – NOT USED

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2.3 APPURTENANCES FOR EXPOSED VALVES

A. General:
1. For valves located less than 5 feet-0 inches above the operating floor, provide levers on 4-inch quarter turn valves and handwheels on all other valves, unless otherwise shown on the Drawings or specified.
2. For valves located at 5 feet-0 inches or more above the operating floor, provide chain operators.
3. Where shown on the Drawings, provide extension stems and floorstands.

B. Handwheels:
1. Conform to the applicable AWWA Standards.
2. Material of Construction: Ductile iron or cast aluminum.
3. Arrow indicating direction of opening and word "OPEN" shall be cast on the trim of the handwheel.

C. Chain Operators:
1. For valves more than 5 feet-0 inches above the operating floor provide chain operators.
2. Chains shall extend to three feet above the operating floor.
3. A 1/2-inch stainless steel hook bolt shall be provided to keep the chain out of the walking area.
4. Materials of Construction:
   a. Chain: Type 304 stainless steel.
   b. Chain wheel: Recessed groove type made out of bronze bushed with guides.
5. Chain Construction:
   a. Chain shall be of welded link type with smooth finish. Chain that is crimped or has links with exposed ends shall not be acceptable.
6. Provide geared operators where required to position chain wheels in vertical position.

D. Crank Operator:
1. Crank operator shall be removable and fitted with a rotating handle.
3. Materials:
   a. Crank: Cast iron or ductile iron.
   b. Handle: Type 304 stainless steel.
   c. Hardware: Type 304 stainless steel.

E. Extension Stems and Floorstands for Valves:
1. Conform to the applicable requirements of AWWA C501 for sizing of the complete lifting mechanism.
2. Bench and Pedestal Floorstands:
a. For valves requiring extension stems, provide bench or pedestal floorstands with handwheel or crank as indicated. Make provisions for use of portable electric actuator for opening and closing of the valves.

b. Type: Heavy-duty with tapered roller bearings enclosed in a weatherproof housing, provided with positive mechanical seals around lift nut and pinion shaft to prevent loss of lubrication and to prevent moisture from entering the housing. A lubrication fitting shall be provided for grease. The base shall be machined.

c. Materials of Construction:
   1) Housing: Cast-iron, ASTM A 126, Class B, or steel.
   2) Lift Nut: Cast bronze, ASTM B 98/B 98M.
   3) Grease Fitting: Stainless steel.
   4) All Bolting: Type 316 stainless steel.

3. Wall brackets for floorstands shall be of Type 316L stainless steel construction.

4. Extension Stems:
   a. Materials of Stems and Stem Couplings: Type 316 stainless steel.
   b. Maximum Slenderness Ratio (L/R): 100.
   c. Minimum Diameter: 1.5-inch.
   d. Threads: ACME.
   e. Stem couplings shall be provided where stems are furnished in more than one piece. The couplings shall be threaded and keyed or threaded and bolted and shall be of greater strength than the stem.
   f. A Type 316 stainless steel cap suitable for the square end of the valve stem shall be welded to the bottom of the extension stem.

5. Bottom Couplings: Ductile iron with Type 316 stainless steel pin and set screw.

6. Stem Guides:
   a. Material: Type 316 cast stainless steel with bronze bushing for stem.
   b. Maximum Stem Length between Guides: Seven feet.
   c. Stem guides shall be adjustable in two directions.

F. Floor Boxes: Provide cast-iron floor boxes for all valves which are to be operated from floor above valve. Boxes shall be equal in depth to floor slab. Boxes shall have cast-iron covers and be fitted with bronze bushing.

2.4 APPURTEINANCES FOR BURIED VALVES

A. Wrench Nuts:
   1. Provide wrench nuts on all buried valves of nominal 2-inch size conforming to AWWA C500.
   2. Arrow indicating direction of opening the valve shall be cast on the nut along with the word "OPEN".
   4. The nut shall be secured to the stem by mechanical means.

B. Extension Stems for Non-Rising Stem Valves and Quarter Turn Buried Valves:
1. Provide extension stems to bring the operating nut to 12-inches below the valve box cover.
2. Minimum Size and Material: Same as valve stem.
4. Provide top nut and bottom coupling of ductile iron with pins and set screws of Type 316 stainless steel.

C. Valve Boxes:
   1. Valve boxes shall be as shown on the Drawings and as required.
   2. Type: Heavy-duty, suitable for highway loading, two piece telescopic, and adjustable. Lower section shall enclose operating nut and stuffing box and rest on bonnet.
   3. Material: Cast or ductile iron.
   5. Marking: As required for service.

2.5 ANCHOR AND MISCELLANEOUS MOUNTING BOLTS

A. All bolts, nuts and washers for connection of the valve appurtenances to concrete structure or other structural members shall be obtained from the valve manufacturer, and shall be of ample size and strength for the purpose intended. Anchor bolts shall be hooked or adhesive type and shall be Type 316 stainless steel. Anchor bolts shall conform to the requirements of Section 05051, Anchor Bolts, Toggle Bolts and Concrete Inserts.

B. Provide anchor bolts for stem guides of required strength to prevent twisting or sagging of the guides under load.

C. Provide bolts and washers of Type 316 stainless steel and nuts of Nitronic 60. The bolts shall have rolled threads and both bolts and nuts shall be electropolished to remove burrs.


2.6 TOOLS AND SPARE PARTS – NOT USED

2.7 PAINTING

A. Clean and shop prime coat and shop finish coat ferrous metal surfaces of equipment in accordance with the requirements of Section 09900, Painting.

B. Coat machined, polished and non-ferrous surfaces including gears, bearing surfaces and similar unpainted surfaces with corrosion prevention compound which shall be maintained during storage and until equipment begins operation.
C. Field painting shall conform to the requirements under Section 09900, Painting.

D. Certify, in writing, that the shop primer and coating system is compatible with the finish coating system in accordance with Section 09900, Painting.

2.8 INSPECTION AND WITNESS SHOP TESTS – NOT USED

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all valves and appurtenances in accordance with the manufacturer's instructions.

B. Conform to appendices of AWWA Standards, where applicable.

C. Install all valves so that operating handwheels or levers can be conveniently turned from operating floor without interfering with access to other valves and equipment, and as approved by the ENGINEER. Orient chain operators out of the way of the walking areas. Mount valves so that indicator arrows are visible from floor level.

D. Install all valves plumb and level. Install all valves to be free from distortion and strain caused by misaligned piping, equipment or other causes.

E. For buried valve installations, set valve boxes plumb and centered, with soil carefully tamped to a lateral distance of four feet on all sides of the box, or to the undisturbed trench face if less than four feet. Provide a flexible coupling next to a buried valve for ease of valve removal.

3.2 FIELD TESTS AND ADJUSTMENTS

A. Adjust all parts and components as required to provide correct operation of the valves.

B. Conduct a functional field test on each valve in the presence of the ENGINEER to demonstrate that each valve operates correctly.

C. Demonstrate satisfactory opening and closing of valves at the specified criteria requiring not more than 40-pounds effort on the manual actuators.

D. Test ten percent valves of each type by applying 200-pounds effort on the manual operators. There shall be no damage to the gear actuator or the valve.
3.3 MANUFACTURER’S SERVICES – NOT USED

+++ END OF SECTION + +
PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment and incidentals required to furnish and install all check valves and appurtenances complete and operational as shown on the Drawings and as specified.
   2. The Work includes, but is not necessarily limited to, all types of valves required for buried, exposed, submerged and other types of piping, except where otherwise specifically included in other Sections.

B. Coordination:
   1. Review installation procedures under other Sections and coordinate with the Work which is related to this Section including buried piping installation, exposed piping installation and site utilities.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications:
   1. Manufacturer shall have a minimum of five years experience of producing substantially similar equipment, and shall be able to show evidence of at least five installations in satisfactory operation for at least five years.
   2. Each type of check valve shall be the product of one manufacturer.

B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
   1. AGMA Standards.
   2. ANSI B16.1, Cast Iron Pipe Flanges and Flanged Fittings.
   3. ANSI B16.4, Cast Iron Fittings.
9. ASTM A 307, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
13. ASTM B 62, Specification for Composition Bronze or Ounce Metal Castings.
14. ASTM D 1784, Specification for Rigid Poly (Vinyl Chloride) PVC Compounds and Chlorinated Poly (Vinyl Chloride) CPVC compounds.
16. AWWA C506, Backflow Prevention Devices - Reduced Pressure Principle and Double Check Valve Types.
17. AWWA C508, Swing Check Valves for Waterworks Service, 2-inch through 24-inch NPS.
18. NEMA, National Electrical Manufacturer's Association.
19. Comply with National Sanitation Foundation (NSF-61) and Arizona Administration Code requirements as stated in Specification Section 01420 – References.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval the following:
   1. Manufacturer's literature, illustrations, paint certifications, specifications, detailed drawings, data and descriptive literature on all valves and appurtenances.
   2. Deviations from Contract Documents.
   3. Engineering data including dimensions, materials, size and weight.
   4. Fabrication, assembly and installation drawings.
   5. Control characteristics of modulating valves.
   6. Certificates of compliance with AWWA Standards, where applicable.
   7. Corrosion resistance information to confirm suitability of the valve materials for the application. Information on chemical resistance of elastomers shall be furnished from the elastomer manufacturers.
   8. Power and control wiring diagrams, including terminals numbers.
   9. Complete manufacturer’s nameplate data of valves.
  10. Special tools list.
  11. Cv Values and headloss curves.

B. Operation and Maintenance Manuals:
   1. Submit complete installation, operation and maintenance manuals including test reports, maintenance data and schedules, description of operation, and spare parts information.
   2. Furnish Operation and Maintenance Manuals in conformance with the requirements of Section 01781, Operation and Maintenance Data.
C. Certificates: Where specified or otherwise required by ENGINEER, submit test certificates.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the site to ensure uninterrupted progress of the Work. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete, in ample time to not delay the Work.

B. All boxes, crates and packages shall be inspected by CONTRACTOR upon delivery to the site. Notify ENGINEER if any loss or damage exists to equipment or components. Replace loss and repair damage to new condition, in accordance with manufacturer’s instructions.

C. Store materials to permit easy access for inspection and identification. Keep all material off the ground, using pallets, platforms or other supports. Protect steel members and packaged materials from corrosion and deterioration.

D. Store all mechanical equipment in covered storage off the ground and prevent condensation and in accordance with the manufacturer’s recommendations for long term storage.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:
   1. Valves shall have manufacturer's name and working pressure cast in raised letters on valve body.
   2. Unless otherwise specified, all flanged valves shall have ends conforming to ANSI B16.1. The pressure class of the flanges shall be equal to or greater than the specified pressure rating of the valves.
   3. All bolts, nuts and studs on/or required to connect buried or submerged valves shall be Type 316 stainless steel.
   4. All bolts and studs embedded in concrete and studs required for wall pipe shall be of Type 316 stainless steel.
   5. For stainless steel bolting, except where Nitronic-60 nuts are required, use anti-seize compound, graphite free, to prevent galling. Strength of the joint shall not be affected by the use of anti-seize compound.
   6. All other bolts, nuts and studs shall, unless otherwise approved, conform to ASTM A 307, Grade B; or ASTM A 354.
   7. Bolts and nuts shall have hexagon heads and nuts.
8. Gasket material and installation shall conform to manufacturer’s recommendations.

9. Identification: Identify each valve 4-inches and larger with a stainless steel manufacturer’s nameplate stamped with the approved designation. Manufacturer’s nameplate shall be permanently fastened to valve body at the factory. Stenciled designations are acceptable for buried valves.

10. All materials of construction of the valves shall be suitable for the applications as shown on the Drawings.

11. Protect wetted parts from galvanic corrosion due to contact of two different metals.

B. 3-Inch Diameter and Larger - Air Cushioned Type:

1. Provide valves conforming to AWWA C508-09 and as specified herein.

2. Valve shall be a counterweighted, rubber seated swing check valve with external air cushion chamber. Valve shall permit flow in one direction only and close tightly, without slamming, when its discharge pressure exceeds its inlet pressure.

3. Valve shall have a hinge shaft located completely above the waterway, and shall be Type 316 stainless steel with the disc-arm and counterweight arm keyed thereon. Hinge shaft packing gland shall be of adjustable packing gland design employing a compression type packing. Simple O-ring shaft seals will not be accepted.

4. Valve shall be tight seating when closed, and provide a full equivalent pipe area when open fully. Seating shall be by a resilient field replacement ring on the valve disc contacting a Type 316 stainless steel seat ring in the valve body.

5. Provide an external adjustable counterweight to initiate valve closure, and an air cushion chamber mounted externally to dampen valve closure due to counterweight action. The air cushion chamber shall be of all bronze or bronze and stainless steel, and shall be field adjustable.

6. Materials of Construction: All materials of construction shall conform to AWWA C508 and shall be as follows for various valve components:

   a. Body, Disc, Cover and Gland: Cast-iron or ductile iron.

   b. Disc Arm: Ductile iron.

   c. Hinge Shaft: Type 316 stainless steel.

   d. Hinge Shaft Bushings: Bronze.

   e. Shaft End Plate: Type 316 stainless steel.

   f. Body Seat: Type 316 stainless steel.

   g. Follower ring for Rubber Seat on Disc: Type 316 stainless steel.

   h. Disc Center Pin Assembly: Type 316 stainless steel.

   i. Air Cushion Chamber:

      1) Chamber and Plunger: Bronze.

      2) Linkages and Pins: Type 316 stainless steel.

      3) Air Check Valve and Tubing: Brass.

   j. All Rubber Items:
1) Up to 180°F Fluid Temperature: Buna-N, or other synthetic rubber suitable for the application.

2) Greater than 180°F Fluid Temperature: Viton, or other synthetic rubber suitable for the application.

k. All internal and external bolting and other hardware including pins, set screws, studs, bolts, nuts and washers: Type 316 stainless steel.


7. Testing:
   a. Test all valves in the shop in conformance with AWWA C508.

8. Shop Painting:
   a. Interior metal surfaces of the valve, except finished or bearing surfaces, shall be shop painted with two coats of an NSF 61 approved epoxy coating applied in accordance with the manufacturer's recommendations.
   b. Exterior surfaces of the valve shall be shop painted as specified hereinafter under Article 2.2, below.

9. Product and Manufacturer: Provide one of the following:
   b. Pratt/CCNE
   c. Or equal.

C. Automatic Electric Check Valves: NOT USED

D. Cone Check Valves: NOT USED

2.2 SURFACE PREPARATION AND PAINTING

A. Valves, appurtenances, etc., shall receive shop primer and shop finish coating conforming to the requirements of Section 09900, Painting. If any damage to the paint system occurs, the equipment shall be repainted as directed by the ENGINEER.

B. Surface preparation and painting shall conform to the requirements of Section 09900, Painting.

C. All gears, bearing surfaces, machined surfaces and other surfaces which are to remain unpainted shall receive a heavy application of grease or other rust-resistant coating. This coating shall be maintained during storage and until the equipment is placed into operation.

D. Certify, in writing, that the shop primer and shop finish coating system conforms to the requirements of Section 09900, Painting.

PART 3 - EXECUTION

91st Avenue WWTP Sludge Solar Drying Beds

15114-5

06/09/17
3.1 INSTALLATION

A. Install all valves and appurtenances in accordance with manufacturer's instructions and recommendations.

B. Unless otherwise approved by the ENGINEER, install all valves plumb and level. Install valves free from distortion and strain caused by misaligned piping, equipment or other causes.

3.2 FIELD TESTS AND ADJUSTMENTS

A. Adjust all parts and components as required to provide correct operation.

B. Conduct functional field test of each valve in presence of ENGINEER to demonstrate that each part and all components together function correctly.

3.3 MANUFACTURER'S SERVICE – NOT USED

++ END OF SECTION ++
SECTION 15441

SUMP PUMPS

PART 1 – GENERAL

1.1 DESCRIPTION
A. Scope:
   1. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required to furnish and install submersible, end suction centrifugal type sump pumps complete and operational with control equipment and accessories.

B. Coordination:
   1. Review installation procedures under other Sections and coordinate with the Work which is related to this Section.

1.2 QUALITY ASSURANCE
A. Manufacturer’s Qualifications:
   1. Manufacturer shall have a minimum of five years of experience of producing substantially similar equipment, and shall be able to show evidence of at least five installations in satisfactory operation for at least five years.
   2. Person(s) adjusting, repairing or receiving training on electrically energized equipment shall follow guidelines outlined in NFPA 70E, OSHA 910, Subpart “S” and OSHA 1926 Subpart “K” regarding arc flash safety, and protection.

B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:
   1. Standards of the Hydraulic Institute, (HI).
   4. Institute of Electrical and Electronic Engineers, (IEEE).
   5. American National Standards Institute, (ANSI).

C. Unit Responsibility: Assign Unit Responsibility as specified in Section 01600, General Equipment Provisions, to the manufacturer or supplier for the equipment specified in this Section. A Certificate of Unit Responsibility shall be provided.

1.3 SUBMITTALS
A. Shop Drawings: Submit for approval the following:
   1. Comply with the requirements of Section 01332, Shop Drawing Procedures.
2. Manufacturer's literature, illustrations, specifications and engineering data including dimensions, materials, size, weight, performance data and curves showing overall pump efficiencies, flow rate, head, brake horsepower, motor horsepower, speed and shut-off head.
3. Fabrication, assembly, installation and wiring diagrams and instructions.
4. Deviations from Contract Documents.
5. Control Panels shall be furnished in accordance with the requirements as shown on the Drawings, and as specified in Division 17000, Sections 17051 – Computer Control System Process Control Descriptions, 17052 – Process Control System Primary Sensors and Field Instruments, and 17260 – Control Panels.

B. Operation and Maintenance Manuals:
   1. Submit complete installation, operation and maintenance manuals including test reports, maintenance data and schedules, description of operation and spare parts information.
   2. Furnish Operation and Maintenance Manuals in conformance with the requirements of Section 01781, Operation and Maintenance Data.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Store materials in compliance with requirements under Section 01661, Storage of Materials and Equipment.

B. Deliver materials to the site to ensure uninterrupted progress of the Work. Deliver anchor bolts and anchorage devices, which are to be embedded in cast in place concrete, in ample time to not delay the Work.

C. All boxes, crates and packages shall be inspected by CONTRACTOR upon delivery to the Site. A document shall be provided by CONTRACTOR, notifying the ENGINEER if any loss or damage exists to equipment or components. Replace loss and repair damage to new condition, in accordance with manufacturer’s instructions.

D. Store materials to permit easy access for inspection and identification. Keep all materials in covered storage, off the ground utilizing pallets, platforms or other supports. Protect steel members and packaged materials from corrosion and deterioration.

E. Store all mechanical equipment to prevent condensation and in accordance with the manufacturer’s instructions for long term storage. Provide power to the space heater while actuators are in storage to avoid condensation on the control devices.
PART 2 - PRODUCTS

2.1 MATERIALS

A. Design Criteria:
   1. Pumps shall be submersible, end suction, centrifugal type. They shall be specially designed, constructed, and installed for the service intended and shall comply with the following minimum design conditions:

(The remainder of this page was left blank intentionally.)
Article I. Design Conditions

<table>
<thead>
<tr>
<th>Location:</th>
<th>Decant Pump Station No. 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number Required:</td>
<td>2</td>
</tr>
<tr>
<td>Type:</td>
<td>Submersible</td>
</tr>
<tr>
<td>Design Flow: gpm</td>
<td>100</td>
</tr>
<tr>
<td>Design TH: ft.</td>
<td>27</td>
</tr>
<tr>
<td>*Max HP at shut-off: hp</td>
<td>2.1</td>
</tr>
<tr>
<td>Min. Efficiency at Design: %</td>
<td>32</td>
</tr>
<tr>
<td>Motor: hp</td>
<td>2.7</td>
</tr>
<tr>
<td>Max. Operating Speed: rpm</td>
<td>1,700</td>
</tr>
<tr>
<td>Suction Lift: ft.</td>
<td>N/A</td>
</tr>
<tr>
<td>Discharge Size: in.</td>
<td>3</td>
</tr>
<tr>
<td>Available NPSH at Design: ft.</td>
<td>N/A</td>
</tr>
<tr>
<td>**Flow at 2nd Design Point: gpm</td>
<td>60</td>
</tr>
<tr>
<td>TH at 2nd Design Point: ft.</td>
<td>37</td>
</tr>
<tr>
<td>Liquid Pumped:</td>
<td>Drain Water</td>
</tr>
<tr>
<td>Temperature: °F</td>
<td>50</td>
</tr>
<tr>
<td>Liquid pH:</td>
<td>7</td>
</tr>
<tr>
<td>Maximum Sphere: in.</td>
<td>1</td>
</tr>
<tr>
<td>Motor: Volts/Phase/Hertz</td>
<td>230/1/60</td>
</tr>
</tbody>
</table>

* Pump horsepower requirements shall not exceed stated horsepower at any point on operating curve.
** Flow at the 2nd design point TH shall be within ten percent of the value specified.

B. General
1. Painting shall conform to the Specifications for surface preparation and shop priming requirements under Section 09900, Painting. All these surfaces shall be considered submerged. For sun-exposed installations, lighter colors to be used are beige, white or light gray. The surface preparation and painting of these surfaces shall be by the manufacturer.
2. Machined, polished and non-ferrous surfaces shall be coated with corrosion prevention compound.

C. Pump Fabrication:
1. End Suction Centrifugal Sump Pump, Submersible Type:
   a. Pumps and motors shall be designed for continuous operation under submergence, without leakage.
b. Pumps shall include an all cast iron housing, cover, base, control chamber and impeller.
c. The motor chamber shall be hermetically sealed against entry of moisture and shall be oil filled.
d. The shaft seal shall be of high quality carbon, stainless steel and Buna-N seal and ceramic seat combination.
e. The shaft shall be of Type 416 stainless steel. Fluids shall not contact the shaft.
f. The impeller shall be semi-enclosed, multi-vane.
g. The bearings shall be sleeve type, permanently lubricated.
h. The motor shall be suitable for operation as shown on the pump schedule.
i. The power cord shall be UL approved, 20-foot length, waterproof and oil resistant, complete with grounding type cord cap and stainless steel strain relief cable grip.
j. The motors shall have built-in overtemp protection.
k. The motors shall have built-in moisture detection.
l. Motors shall conform to the requirements of Section 11000, Electric Motors.

D. Accessory Equipment:
1. Provide the following accessories for each pump as required for a complete installation.
   a. Anchor Bolts: Type 316 stainless steel.
   d. Safety Chain Hook: Type 316 stainless steel.
   e. Cable Holder and Support Grip: Type 316 stainless steel.
   f. Discharge Elbow: Ductile iron.

E. Product and Manufacturer: Provide one of the following:
1. Flygt, Model CP3068 HT.
2. Equal.

F. Simplex Controls:
1. Provide a complete 120V Local Control Panel as shown on contract drawings, consisting of pump controls, high level alarms, CCS status and alarms. The panel controls shall be furnished in accordance with the requirements as shown on the Drawings, and as specified in Division 17000, Sections 17051 – Computer Control System Process Control Descriptions, 17052 – Process Control System Primary Sensors and Field Instruments, 17053 – Process Control System Instrument Index, 17226 – Process Control System I O List, and 17260 – Control Panels. All panel enclosures shall conform to the requirements of specification 16050 - General Provisions.

2. Pump Controls: Provide the following pump controls for the control panel:
a. Provide combination motor starter with either manual or electrical reset pushbutton on the front panel for the motor overload protection.
b. Main disconnect with lockable handle through cabinet door with auxiliary contacts. Provide additional circuit breaker protection for isolation of the motor control logic.
c. Running light.
d. LOCAL-OFF-AUTO selector switch.
e. Motor overload indication.
f. Start pushbutton.
g. Stop pushbutton.
h. Pump Fail

3. High Level Alarm Circuitry: Provide the following for the High Level control logic.
   a. Provide external 120V power feed for the alarm circuit and indicators to the control circuit within the control panel for LSHH (High-High Level).
   b. Panel mounted alarm horn and light indicator.
   c. Alarm silence pushbutton.
   d. Remote Mounted Horn and Blue Light/Strobe, as shown on drawings, in addition to the panel mounted alarm horn and light indicator.

4. Computer Control System (CCS) Status and Alarms: Provide the following for the CCS status and alarms.
   a. Equipment in Auto status to CCS.
   b. Motor Overload alarm to CCS.
   c. Equipment Run status to CCS.
   d. Power Fail alarm to CCS.
   e. High-High Sump Level (LSHH) alarm to CCS.
   f. Pump Fail alarm to CCS

5. Level Equipment:
   a. Provide Float type Level switches per 17052 as listed below and shown on Drawings:
      1) Floats:
         (i) Low-Low Level (for wet sump applications or low level cutoff)
         (ii) Low Level
         (iii) High Level
         (iv) High-High Level
      2) Support Bracket: Type 316 stainless steel.
      3) Cable Supports: Polypropylene composition clamp with Type 316 stainless steel bolts.
      4) Mercury type devices are not allowed.
6. Panel Manufacturers:
   a. Refer to 17260 manufacturers list for approved panel manufacturers.

2.2 TOOLS, SPARE PARTS AND MAINTENANCE MATERIALS

A. Spare parts shall be packed in sturdy containers with clear indelible identification markings and shall be stored in a dry, warm location until transferred to the OWNER at the completion of the project. Comply with the requirements of Section 01783, Spare Parts and Maintenance Materials.

B. Coordinate with the OWNER to determine that the appropriate Tools, Spare Parts and Maintenance Materials are being provided.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Inspect all equipment immediately upon delivery to site. If damaged, notify ENGINEER and manufacturer immediately.

B. Do not install damaged equipment until repairs are made in accordance with manufacturer’s written instructions and approved by the ENGINEER. Only minor repair work shall be permitted in the field. All other damaged items shall be sent to factory for repair or replacement.

3.2 START-UP AND TEST

A. After completion of installation, the system shall be completely tested to ensure compliance with the operating requirements as specified, indicated on the Drawings and in accordance with Section 01752, Equipment and System Startup and Performance Testing. Should the tests indicate any malfunction, make any necessary repairs and/or adjustments. Such tests and adjustments shall be repeated until, in the opinion of the ENGINEER, the installation is complete and the equipment is functioning properly and accurately, and is ready for permanent operation.

B. A factory trained service representative shall be provided for installation supervision, initial setting and start-up testing services. The representative shall make a minimum of 1 visits to the site to approve the completed installation and to perform start-up testing of the equipment. The representative shall coordinate each visit with the ENGINEER prior to arrival on the site. The representative shall test operate the system in the presence of the ENGINEER and verify that the equipment conforms to requirements. The representative shall revisit the job site as often as necessary until the installation and testing is entirely satisfactory.

3.3 TRAINING

A. A factory trained service representative shall be provided for operation and maintenance personnel training services. The representative shall make a minimum
of 1 visits to the site to perform the services as described under Section 01821, Instruction of Operations and Maintenance Personnel. The representative shall coordinate each visit with the ENGINEER prior to arrival on the site.

B. For the factory trained service representative, all costs, including travel, lodging, meals and incidentals, shall be considered as included in the bid price.

++ END OF SECTION ++
SECTION 15832

CENTRIFUGAL ROOF EXHAUST FANS - ALUMINUM

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
1. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required to furnish and install centrifugal roof fans complete and operational with all accessories.

B. Items Furnished But Installed Under Other Sections:
1. Prefabricated Curbs furnished under this Section and installed by CONTRACTOR.

C. Electrical power supply, related conduits and wiring is under Division 16, Electrical.

D. Electrical power supply tie boxes and PVC coated galvanized rigid steel conduit related to the roof fans shall comply with the wet location requirements as specified under Division 16, Electrical.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications:
1. Manufacturer shall have a minimum of five years experience of producing substantially similar equipment and shall be able to show evidence of at least five installations in satisfactory operation for at least five years.

B. Requirements of Regulatory Agencies: Comply with applicable provisions of regulatory agencies below and others having jurisdiction.
2. Underwriters' Laboratories, Incorporated (UL).
4. City of Phoenix – Amendments to the National Electrical Code.

C. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
3. Underwriters' Laboratories, Incorporated (UL).
5. City of Phoenix - Amendments to the National Electrical Code.

D. Source Quality Control: Perform following tests and inspections at factory:
   1. Fan wheels shall be statically and dynamically balanced.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval the following:
   1. Manufacturer's literature, illustrations, specifications and engineering data to include the following information:
      a. Dimensions and weights.
      b. Materials of construction.
      c. Mounting details.
      d. Performance Data - AMCA approved fan curves and noise data for each model specified.
      e. Prefabricated curb details.
      f. Deviations from Contract Documents.

B. Test Reports: Submit the following test certifications for approval.
   1. AMCA Label.
   2. UL Label.

C. Operation and Maintenance Data:
   1. Submit complete installation, operation and maintenance manuals including test reports, maintenance data and schedules, description of operation and spare parts information.
   2. Furnish Operation and Maintenance Manuals in conformance with the requirements of Section 01781, Operation and Maintenance Data.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the site to ensure uninterrupted progress of the Work. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete, in ample time to prevent delay of the Work.

B. All boxes, crates and packages shall be inspected by CONTRACTOR upon delivery to the site. Notify ENGINEER if any loss or damage exists to equipment or components. Replace lost equipment or components and repair damage to new condition, in accordance with manufacturer's instructions.

C. Store materials to permit easy access for inspection and identification. Keep all material off the ground, using pallets, platforms, or other supports, and in accordance
with the manufacturer's recommendations for long term storage. Protect steel members and packaged materials from corrosion and deterioration.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Design conditions shall be as indicated on the Equipment Schedule located in this Section.

B. Style: Upblast centrifugal roof fan.

C. Housing:
   1. Main Housing:
      a. Spun aluminum construction reinforced to withstand wind forces without damage.
      b. Waterproof construction for inlet through roof, motor, impeller, drive and wiring.
   2. Motor Housing:
      a. Same material and construction as main housing.
      b. May be portion of main housing.
      c. Weatherproof, ventilated housing baffled to separate motor from air stream, unless noted on Equipment Schedule.
      d. Removable for access to motor.
   3. Isolate vibrations of motor and impeller assembly from base and housing with rubber or neoprene cushions.
   5. Finish:
      a. Factory applied corrosion resistant finish on all surfaces (inside and outside):
         1) Lenkote.
         2) Eisenheiss.
         3) Or equal.
      b. Color: to be determined by the owner.

D. Base:
   1. One piece aluminum construction with molded-in venturi.
   2. Finish and color to match main housing.
   3. Screwed or lagged to curb in manner that allows for easy removal for damper service.

E. Impeller:
   1. Air foil design.
   2. Backward curved.
4. Dynamically and statically balanced.
5. Fabricated of extruded aluminum.
6. Self-aligning, permanently lubricated impeller shaft ball bearings designed for thrust load.
7. Factory applied corrosion resistant coating:
   a. Lenkote.
   b. Eisenheiss.
   c. Or equal.

F. Motors:
1. Motors shall conform to the requirements of Section 11000, Electric Motors.
2. Type: Single or two speed as shown on the Drawings or in accordance with Paragraph 2.1.H., below.
3. Enclosure: TEFC. Explosion-proof where shown on the Drawings or in accordance with Paragraph 2.1.H., below.
4. Horsepower: As shown on Drawings or in accordance with Paragraph 2.1.H., below. Motor to be non-overloading at any point on operating curve of fan.
5. Motors shall be supplied with Class H insulation and rated for continuous duty at 55°C ambient temperature.
6. Mounting: Motor to be mounted on adjustable or slotted face plates with rubber or neoprene cushions.
7. Disconnects and Lockout Stops: Provide factory mounted factory wired, unfused disconnects for all single phase motors. Provide factory mounted NEMA 4X junction box and lockout stop pushbutton for three phase motors for all roof fans.
8. Overload Protection: Provide integral overload protection on all single phase motors.
10. Power Supply: As shown on the Drawings or in accordance with Paragraph 2.1.H., below.
11. Two speed motors shall be two winding type (full and two third speed) or as shown on the Drawings or in accordance with Paragraph 2.1.H., below.

G. Drive:
1. Direct drive or belt drive with adjustable sheaves as shown on the Drawings or in accordance with Paragraph 2.1.H., below.
H. Equipment Schedule:

<table>
<thead>
<tr>
<th>Equipment Tag Number</th>
<th>Location</th>
<th>Nominal Capacity, SCFM</th>
<th>Static Pressure (inches w.c.)</th>
<th>Max. Fan Speed, RPM</th>
<th>Max. Motor, HP</th>
<th>Wheel Diameter, inches</th>
<th>Drive Type</th>
<th>Voltage/Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>08P540</td>
<td>Decant Pump Station No.2</td>
<td>3,500</td>
<td>0.75</td>
<td>1125</td>
<td>1.0</td>
<td>27</td>
<td>Belt</td>
<td>460 V / 3 Ph</td>
</tr>
</tbody>
</table>

I. Product and Manufacturer: Provide one of the following:
1. Loren Cook Company.
2. Penn Ventilator Company.
4. Or equal.

2.2 ACCESSORIES

A. Backdraft Dampers:
1. Gravity operated:
   a. Multiple, interlocked blades, aluminum construction.
   b. Felt gasketed blade edges.
   c. Stainless steel or brass bearings.
   d. Tie rod connecting each blade.
   e. Counterweights or adjustable spring attached to tie rods.
   f. Located in roof curb.
   g. Furnished by CONTRACTOR from the same manufacturer as for the centrifugal roof fan.
2. Coordinate electrical conduit location through roof or use the existing.

B. Bird Screen: 1/2-inch (13 mm) mesh, poly-vinyl chloride coated, metal screen securely anchored to housing at air outlet.

C. Curb Gasket: Self-adhesive rubber gasket cemented to inner edge of curb to provide air and water seal between curb and housing.

D. Base to Curb Fasteners: Type 316 stainless steel lag screws and bolts.

PART 3 - EXECUTION

3.1 INSPECTION
A. Examine curbs to receive fans for:
   1. Level fan mounting surface.
   2. Water tightness.
   3. Proper anchoring and flashing of prefabricated curb to roof deck.
   4. Unevenness, irregularities, and incorrect dimensions that would affect quality and execution of installation.

B. Do not proceed with installation of fan until curbs conform to the requirements of this Section.

3.2 INSTALLATION

A. Install roof fan in accordance with manufacturer's installation instructions and recommendations.

B. Anchor to wood nailer on curb with stainless steel lag screws or bolts.

3.3 TESTING AND ADJUSTING

A. Start unit and observe for excessive noise or vibration.

B. Adjust fan sheaves for proper fan speed.

C. Adjust belt tension.

3.4 CLEANING

A. Remove all debris and waste materials resulting from installation.

B. Clean tar, dirt and marks from exterior of units.

C. Touch up all chips in factory finishes.

3.5 MANUFACTURER'S SERVICES

A. A factory trained representative shall be provided for installation supervision, start-up and test services and operation and maintenance personnel training services. The representative shall make a minimum of 2 visit, minimum 2 hours on-site for each visit, to the site. The first visit shall be for assistance in the installation of equipment. The second visit shall be for checking the completed installation and start-up of the system. The third visit shall be as described under Section 01821, Instruction of Operations and Maintenance Personnel. Manufacturer's representative shall test operate the system in the presence of the ENGINEER and verify that the centrifugal roof exhaust fans conform to requirements. Representative shall revisit the job site as
often as necessary until all trouble is corrected and the installation is entirely satisfactory.

B. All costs, including travel, lodging, meals and incidentals, shall be considered as included in CONTRACTOR’S bid price.

++ END OF SECTION ++
SECTION 16050

GENERAL PROVISIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified, and required to complete the electrical Work.
   2. Equipment shall be rated and labeled by the manufacturer for the environmental conditions in which it is installed including the power disconnects, control stations, and wiring systems.
   3. Conduits and circuits within electrical distribution or utilization equipment and cabinets shall be identified and labeled as specified and as shown.

B. Coordination:
   1. Review installation procedures, drawings and schedules under other Sections and coordinate with other trades the installation of electrical items that must be installed with or within formwork, walls, partitions, ceilings and panels.
   2. Responsible for the installation of all conduits, inserts, and other items to be embedded in the concrete, or built into walls, partitions, ceilings or panels constructed by other contractors. Provide other contractors with detailed plans or sketches of the location of said conduits and other built-in items as may be required. Stay fully informed of the construction where conduits and other built-in items are to be installed. Install said conduits and other built-in items in such a manner and within such time periods as will not unnecessarily delay the work of the other contractors.
   3. Arc Flash Coordination: Review Electrical Pre-Submittal coordination efforts during the Pre-Construction Conference, section 01301 with CONTRACTOR, STUDY FIRM, ARC FLASH FACILITATOR and the ENGINEER.
      a. Agenda items for Pre-Construction Conference shall include:
         1) Submittal review routing protocols.
         2) Discuss procedures to handling equipment found to have an incident energy level that requires above a Level 2 PPE.
         3) Electrical safety label installation, as identified in specification 16215.
         4) Single Line Diagram and Power Panel Schedule Record Documents.

C. General:
   1. Interpretation of Drawings:
      a. Dimensions shown on the Drawings that are related to equipment are based on the equipment of one manufacturer. Confirm the dimensions of the equipment furnished to the space allocated for that equipment.
b. The Drawings show the principal elements of the electrical Work. They are not intended as detailed working drawings for the electrical Work, but as a complement to the Specifications to clarify the principal features of the electrical systems.

c. It is the intent of the Drawings and Specifications that all equipment and devices, furnished and installed under this Contract, be properly connected and interconnected with other equipment and devices so as to render the installations complete for successful operation, regardless of whether all the connections and interconnections are specifically mentioned in the Specifications or shown on the Drawings.

d. It also is the intent of the Contract Documents that similar products are provided by the same manufacturer for uniformity on the Project.

D. Work Installed by CONTRACTOR But Furnished By Others:
   1. None.

E. Temporary Power and Lighting:
   1. Refer to Section 01511, Temporary Electricity, for temporary power during construction.
   2. Refer to Section 01512, Temporary Lighting, for temporary lighting during construction.
   3. If utilizing existing facility power, provide updated panel schedules and/or load summaries to the ENGINEER and OWNER identifying the recommended power sources and circuits for temporary services. ENGINEER and OWNER must provide approval prior to connecting to the services.

F. Utilities:
   1. Furnish and install empty conduits and ground for telephone service per utility shop drawings. Plywood backboards and punch-blocks shall be furnished and installed for telephone service, as required for contractor’s job-site trailers. Coordinate with City of Phoenix, Information Technology Services (ITS) Department and Telephone Utility. Plywood backboards shall be painted with approved fire retardant paint. Coordinate with City of Phoenix ITS project requirements and apply for service. Submit all necessary documents and fees required to Telephone Utility.

1.2 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:
   1. Permits: Obtain all permits and pay fees required to commence Work and, upon completion of the Work, obtain and deliver to the ENGINEER a Certificate of Inspection and Approval from the authority having jurisdiction.
   2. Codes: Material and equipment shall be installed in accordance with the current standards and recommendations of the National Electrical Code, the National...
Electrical Safety Code and with local codes which apply. Where discrepancies arise between codes, the most restrictive regulation shall apply.

3. Tests by Independent Regulatory Agencies: Electrical material and equipment shall be new and shall bear the label of the Underwriters’ Laboratories, Inc., or other nationally-recognized, independent testing laboratory, wherever standards have been established and label service regularly applies.

4. Utilities:
   a. Power Company: Work in connection with the electric service and utility metering shall be done in strict conformance with the requirements of .
   b. Telephone Company: Work in connection with the telephone lines for the telephone service shall be done in strict conformance with the requirements of the Telephone Company. Telephone system within the Plant is a private system and shall be coordinated with the City of Phoenix, Information Technology Department.
   c. City of Phoenix, Information Technology Department.

B. Reference Standards: Electrical material and equipment shall conform in all respects to the latest approved standards of the following:
1. National Electrical Manufacturers Association (NEMA).
3. The Institute of Electrical and Electronic Engineers (IEEE).
4. Insulated Cable Engineers Association (ICEA).
8. The Instrumentation, Systems and Automation Society (ISA).
10. Underwriter’s Laboratories, Inc. (UL).
11. Occupational Safety and Health Administration (OSHA).

C. Wiring Coordinator:
1. Retain the services of a Wiring Coordinator who shall prepare complete point-to-point interconnection wiring diagrams. The diagrams shall identify all external interconnecting wiring associated with all new and modified existing equipment.
   a. Qualifications: Coordinator shall have experience in the development of diagrams of the type specified and shall have served in a similar role on a project of similar size and complexity.
      1) Present qualifications and approach for the project at Pre-Construction Conference specified under Section 01301, Pre-Construction Conference.
      2) Prepare the items listed below for presentation at the Pre-submittal Meeting. Submit copies to ENGINEER three weeks prior to date of meeting.
a) List of projects where the Wiring Coordinator developed point-to-point wiring diagrams.
b) Samples of diagrams that were developed for the listed projects.
c) Example wiring diagram proposed for the Work with a preliminary list of drawings to be produced.
d) Plan of how information will be obtained and documented.

b. Responsibilities:
1) Develop diagrams for performance of the Work and to document terminations. Prepare diagrams in accordance with the requirements specified under this Section. The diagrams shall be in addition to loop diagrams specified in Section 17001, Process Control System General Requirements for Process Instrumentation.
2) Use information obtained from approved Shop Drawings, Record Drawings and field inspections as required to complete the diagrams.
3) Attend Pre-submittal Meeting and periodic coordination and progress meetings specified in Section 17001, Process Control System General Requirements for Process Instrumentation.
4) Provide point-to-point wiring checks and record detailed test findings and submit to the ENGINEER. After confirmation by the CONTRACTOR, notify OWNER/ENGINEER to witness the point-to-point wiring checks and to verify tests have been completed as recorded.

1.3 SUBMITTALS

A. Refer to Section 01330, Submittals and Section 01332, Shop Drawing Procedures.

B. Shop Drawings shall include the following information to the extent applicable to the particular item:
   1. Manufacturer’s name and product designation or catalog number, including environmental rating such as “Rated for Outdoor Use” or “Rated for Hazardous Location”.
   2. Electrical ratings.
   3. Conformance to applicable standards or specifications of ANSI, ASTM, ICEA, IEEE, ISA, NEC, NEMA, NFPA, OSHA, UL, or other organizations.
   4. Dimensioned plan, section, elevations and panel layouts showing means for mounting, conduit connection, and grounding.
   5. Materials and finish specification, including paints.
   6. List of components including manufacturer’s names and catalog numbers.
   7. Internal wiring diagram and drawings indicating all connections to components and numbered terminals for external connections.

1.4 PROJECT CLOSEOUT

A. Operation and Maintenance Data: Submit complete manuals including:
1. Copies of all Record Drawings and Wiring Diagrams, test reports, Power System Study, maintenance data and schedules, description of operation, and spare parts information.

2. Furnish Operation and Maintenance Manuals in conformance with the requirements of Section 01781, Operation and Maintenance Data.

B. Record Drawings:

1. Furnish copies of Record Drawings in accordance with the requirements of Section 01782, Record Documents, including:
   a. System Record Drawings: Include the following:
     1) One line wiring diagram of the distribution system.
     2) Accurate and detailed in place conduit and cable layouts with schedule of conduit sizes and number and size of conductors.
     3) Layouts of the power and lighting arrangements and the grounding system.
     4) Control schematic diagrams, with terminal numbers and all control devices identified, for all equipment.
   b. Point-to-Point Interconnection Wiring Diagram Drawings: Include the following:
     1) External wiring for each piece of equipment, panel, instrument and other devices and conduit wiring to control stations, lighting panels and motor controllers.
     2) Numbered terminal block identification for each wire termination.
     3) Identification of the assigned wire numbers for all interconnections.
     4) Identification of all conduit wiring by the conduit tag in which the wire is installed.
     5) Terminal and pull boxes through which wiring is routed.
     6) Identification of all equipment and the Shop Drawing transmittal numbers for equipment from which the wiring requirements and termination information was obtained.

2. The Record Drawings shall reflect final equipment and field installation information.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials: Instruct the manufacturers and vendors as to the maximum shipping sizes of equipment that can be accommodated at the site.

B. Storage of Materials: Refer to and comply with the requirements of Section 01661, Storage of Materials and Equipment.

C. Handling of Materials: Refer to and comply with the requirements of Section 01651, Transportation and Handling of Materials and Equipment.

1.6 JOB CONDITIONS

91st Avenue WWTP Sludge Solar Drying Beds 16050-5 03/29/17
A. Existing Conditions:
   1. Examine the site and existing facilities in order to compare them with the Contract Documents with respect to the conditions of the premises, location of and connection to existing facilities and any obstructions which may be encountered.
   2. Perform the Work with due regard to safety and in a manner that will not interfere with the existing equipment or in any way cause interruption of any of the functions of the plant.
   3. Work shall be carried out with a minimum amount of disruption to the operation of the existing plant and with prior approval of OWNER. Submit for approval by OWNER, a detailed written procedure for work which affects operation of the existing plant, a detailed procedure for modifying any existing electrical equipment, including appropriate Personal Protective Equipment (PPE) required if equipment must remain energized while conducting work, anticipated time required to complete the Work, and the required shutdown time, if any.
   4. Where the Work of CONTRACTOR ties in with existing installations, take prior precautions and safeguards in connecting the Work with the existing operating circuits so as to prevent any interruption to the existing operating circuits. The tying in of Work, installed under this Contract, with the existing circuits shall be performed only in the presence of OWNER. Advance notice will be required before any equipment is removed from service. Notify OWNER, in writing, of his intention to do such work, providing full details.

B. Demolition:
   1. The demolition of electrical power distribution equipment, instrumentation/control equipment, conduit, wire and appurtenances shall be in accordance with Section 02220, Demolitions.

1.7 CONTROL CABINETS AND PANELS

A. All outdoor panels, with electronics and temperature sensitive instruments, shall be provided with sunshade structures. Sunshade structures shall be constructed as shown on drawings.

B. All control cabinet and panel materials shall be as follows, unless otherwise specified or noted on the Drawings.

   Proved the following types of enclosures:
   1. All indoor locations:
      a. Dry or non-corrosive, NEMA 12
      b. Wet or corrosive locations, NEMA 4X - 316 stainless steel.
   2. All outdoor locations, NEMA 4X - 316 stainless steel.
   3. All explosion proof locations, NEMA 7.

C. Provide the following enclosure features:
   1. NEMA 12 Enclosures:
      a. Fabricate enclosures using minimum 14 gage steel for wall or frame mounted
enclosures and minimum 12 gage for free standing enclosures. Keep steel free of pitting and surface blemishes.
b. Continuously weld all exterior seams and grind smooth. Also, surface grind complete removal of corrosion, burrs, sharp edges and mill scale.
c. Reinforce sheet steel with steel angles where necessary to adequately support equipment and ensure rigidity and to preclude resonant vibrations.
d. Provide control panel with flatness within 1/16-inch over a 24-inch by 24-inch area, or flat within 1/8-inch for a larger surface. Verify flatness by using a 72-inch long straight edge. Limit out-of-flatness to gradual and in one direction only with no obvious depressions or wavy sections.
e. Use pan type construction for doors. Door widths are not to exceed 36-inches.
f. Mount doors with heavy duty hinge(s) with stainless steel hinge pins.
g. Provide handle-operated, oil-tight, key-lockable three-point stainless steel latching system with rollers on latch-rod(s) for easy door closing.
h. Product and Manufacturer: Provide one of the following:
   1) Hoffman
   2) Hammond
i. Painting:
   1) Completely clean all interior and exterior surfaces so they are free of corrosive residue, oil, grease and dirt. Apply zinc phosphate for corrosion protection.
   2) Apply one coat of primer interior and exterior surfaces immediately after corrosion protection has been applied.
   3) Coat exterior surfaces with primer surface applied with sanding and cleaning between coats, until a Grade 1 finish can be produced on the finish coat.
   4) Paint all exterior surfaces minimum of three finish coats of polyurethane enamel to ultimately produce a Grade 1 finish (super smooth; completely free of imperfections). Color to be selected by ENGINEER from complete selection of standard and custom color charts furnished by the manufacturer. Provide one extra quart of touch-up paint for each exterior finish color.
   5) Provide compatible primer and finish paint with a low VOC, high solids polyurethane enamel. Paint interior surfaces with two coats of semi-gloss white polyurethane enamel.
   6) Product and Manufacturer:
      a) Hi-Solids Polyurethane B65 W300 Series as manufactured by Sherwin Williams, Inc
      b) Or equal.

3. NEMA 4X Enclosures:
   a. Provide enclosures with Type 316 stainless steel construction. Wall or frame mounted enclosures fabricate using a minimum 14 gage steel. Free standing enclosures fabricate using a minimum 12 gage steel. Enclosures smaller than
14”x 12”x 6” fabricate using a minimum of 16 gage steel. Keep steel free of pitting and surface blemishes. Provide all surfaces with a smooth brushed finish.

b. Provide stainless steel fast-operating clamp assemblies on three sides of each door.

c. Rolled lip around three sides of door and along top of enclosure opening.

d. Provide a hasp and staple for padlocking.

e. Provide 3-inch high channel base assembly, with solid bottom, drilled to mate the panel to its floor pad for free-standing panel.

f. Provide 5/16-inch diameter copper ground studs for the ground connection points for all panel equipment and panel doors.

g. Product and Manufacturer: Provide one of the following:
   1) Hoffman
   2) Hammond

4. NEMA 7 Enclosures;
   a. House monitoring and measuring devices located in hazardous environments in explosion-proof control enclosures.
   b. Enclosures rated for use in NEC Class I, Groups C&D or Class II, Groups E, F & G applications and comply with UL and CSA standards.
   c. Required Features:
      1) Light weight and corrosion resistant copper-free aluminum
      2) Integral, cast-on mounting lugs
      3) Left side door hinges
      4) Viewing windows sized to suit internally mounted components
      5) Stainless steel cover bolts
      6) Cad-plated steel mounting pans
   d. Product and Manufacturer: Provide one of the following:
      1) Adalet
      2) Killark
      3) Crouse-Hinds

1.8 ELECTRICAL EQUIPMENT

A. All electrical equipment shall be capable of operating successfully at full-rated load, without failure, with an ambient outside air temperature range of 25°F to 131°F and an elevation of feet (MSL).

B. All electrical devices and equipment shall have ratings based on 75°C terminations.

C. Mounting of electrical equipment on handrails is not allowed.

1.9 AREA CLASSIFICATIONS
A. Materials and equipment shall conform to the area classification(s) shown on the Drawings, specified and required.

B. Wet/Corrosive Locations: The following areas shall be considered wet/corrosive locations:
   1. All outdoor areas.
   2. All indoor areas below grade, unless otherwise specified.
   3. Indoor areas above grade where shown on the Drawings.
   4. Chemical containment and storage areas.

C. Corrosive Locations: The following areas shall be considered corrosive locations:
   1. 

D. Hazardous Locations: The following areas shall be considered hazardous areas as shown on the Drawings.
   1. Class 1, Division 1.
   2. Class 1, Division 2.
   3. Class 2, Division 1.
   4. Class 2, Division 2.

   Materials, equipment and incidentals in areas identified as hazardous locations shall meet NEC requirements for the Class and Division designated.

1.10 SCHEMATIC DIAGRAMS

A. Schematic diagrams are provided for CONTRACTOR’S guidance in fulfilling the operational intent of the Contract Documents.

B. Responsibility belongs to CONTRACTOR to meet all safety and electrical codes, and to provide all equipment, appurtenances and specialty items required to provide for complete and operable systems.

C. Review of control schemes submitted by CONTRACTOR does not relieve CONTRACTOR of his contractual responsibility to provide complete and successfully operating systems.

PART 2 - PRODUCTS

2.1 NAMEPLATES

A. Material: Laminated phenolic, engraved to show 3/16-inch high letters, Arial Font, unless stated else where in the CONTRACT DOCUMENTS for a specific piece of equipment. The letters shall be black with white background or match existing.
B. Border: Minimum 1/8-inch around engraved print with extra length for fastening devices.

C. Fasteners: Secured with #4-40, round-head, stainless steel, self-tapping screws.

2.2 WIRE MARKERS

A. Refer to Section 16122, 600 Volt Cable.

2.3 CONDUIT TAGS

A. Refer to Section 16131, Rigid Conduit.

PART 3 - EXECUTION

3.1 EQUIPMENT IDENTIFICATION

A. Provide identification of each electrical item, in addition to the manufacturer’s nameplates, to identify the item’s function, and the equipment or system which it serves or controls.

B. Identify equipment by means of nameplates. Re-label existing equipment whose designation has been changed. Identify potential arc flash hazard levels on equipment with the label specified in Section 16215 – Power Study.

C. Identify pull and terminal boxes with nameplates. Identify each box by a unique number. Numbering system shall reflect the actual designations used in the field and as documented on wiring diagrams.

D. Process/Mechanical/Electrical equipment located outdoors shall be labeled by the manufacturer: “For Outdoor Use”.

++ END OF SECTION ++
SECTION 16061

GROUNDING SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required to furnish and install complete grounding for the electrical systems, structures and equipment.
   2. Pump cans and buried piping shall be bonded to the ground grid.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified:

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval the following:
   1. Manufacturer’s technical information for grounding materials proposed for use.
   2. Listing of grounding connector types identifying where they are to be used.
   3. Layouts of each structure ground grid.
   4. Test point construction details.
   5. Ground resistance test procedure.
   6. Results of ground resistance tests at each test point. Provide the test information and results as required on form 16000-N in Specification 01331 – Reference Forms.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Bare Ground Cable:
   1. Material: Annealed, bare, stranded copper, No. AWG minimum size.
   2. Product and Manufacturer: Provide ground cable of one of the following:
      a. Southwire Corporation.
b. Service Wire Corporation.
c. Encore Wire Company.

B. Ground Rods:
1. Material: Copperclad rigid steel rods, 3/4-inch diameter, ten feet long.
2. Manufacturer: Provide ground rods by one of the following:
   a. ERICO.
   b. A.B. Chance Company.
   c. South Atlantic, L.L.C.
   d. Harger.

C. Grounding Connectors:
1. Material: Pressure connectors shall be copper alloy castings, designed specifically for the items to be connected, and assembled with Durium or silicone bronze bolts, nuts and washers. Welded connections shall be by exothermic process utilizing molds, cartridges and hardware designed specifically for the connection to be made.
2. Product and Manufacturer: Provide grounding connectors of one of the following:
   a. Pressure Connectors:
      1) O.Z./Gedney, Division of General Signal Corporation.
      2) Burndy Corporation.
   b. Welded Connections:
      1) Cadweld by Erico Products, Incorporated.
      2) Therm-O-Weld by Burndy Corporation.

D. Concrete Boxes:
1. Material: High density reinforced concrete box with non-settling shoulders positioned to maintain grade and facilitate back filling with steel checker plate screw down cover.
2. Product and Manufacturer: Provide box assembly from one of the following:
   a. Concrete Box:
      1) Christy Concrete Products, Inc. Model #B1017.
      2) Or Equal.
   b. Steel Cover:
      1) Christy Concrete Products, Inc. Model #B61JH labeled “GROUND”.
      2) Or Equal.

PART 3 - EXECUTION

3.1 STRUCTURE GROUND SYSTEM

A. Provide ground grids as shown on the Drawings.

B. Install No. 4/0 AWG bare copper cable. Install the cable around the exterior perimeter of structures, minimum 2 feet-6 inches below grade, unless otherwise shown on the Drawings.
C. Install ground rods where shown on the Drawings. Install additional ground rods, if necessary, to attain a resistance to ground of less than twenty five (25) ohms for each ground grid.

D. For structures with steel columns, install 4/0 AWG ground cable. Install cable from grid to each column around the perimeter of the structure. Connect cable to steel using exothermic welds.

E. Connect grids to a continuous underground water pipe system, when practical.

F. Provide concrete ground test wells for measuring the ground resistance of each separately derived system prior to terminating in equipment. Provide 12” ground conductor slack loop in each well. Route ground conductor from test well to equipment in PVC conduit.

G. Weld all buried connections. Test points connections shall utilize pressure connectors.

3.2 EQUIPMENT GROUNDING

A. Ground all electrical equipment in compliance with the National Electrical Code and the City of Phoenix Electrical Code.

B. Equipment grounding conductors shall be bare stranded copper cable of adequate size installed in metal conduit where necessary for mechanical protection. Ground conductors, pulled into conduits with non-grounded conductors, shall be insulated. Insulation shall be green.

C. Panel Grounding:
   1) A minimum size of 4/0 AWG bare stranded copper cable shall be installed between the ground grid and the panel enclosure grounding lug. The mounting frame for panels shall be grounded to the ground grid.
   2) A minimum size of 6 AWG insulated green stranded copper cable shall be installed between the ground grid and the isolated DC Ground Bus located on the enclosure sub-panel. This ground shall be installed in all panels that provide an isolated DC Ground Bus.

D. All conduits entering enclosures shall be grounded. A separate green insulated ground conductor sized per conduit schedule as shown on DRAWINGS or NEC requirements shall be pulled into conduits and connected utilizing grounding conduit bushings.

E. Connect ground cable to piping by welding or brazing. Use copper bonding jumpers on all gasketed joints.

F. Connect ground cable to equipment by means of lug compressed on cable end. Bolt lug to equipment frame using holes or terminals provided on equipment specifically for grounding.
Do not install with hold down bolts. Where grounding provisions are not included, drill suitable holes in locations designated by ENGINEER.

G. Connect to motors by bolting directly to motor frames, not to sole plates or supporting structures.

H. Connect to service water piping by means of copper clamps. Use copper bonding jumpers on gasketed joints.

I. Scrape bolted surfaces clean and coat with a conductive oxide-resistant compound.

3.3 GROUND GRID TESTING

A. The CONTRACTOR shall contract the firm as the Study Firm to provide testing of the grounding electrode system as shown on DRAWINGS.
   1. Performing the following ground single point test:
      a. Conduct test at the testing point(s) locations as shown on the DRAWINGS using a clamp-on ground tester.
         1) Utilize the following test equipment:
            a) Fluke, Model 1625 Kit
      b. Visually inspect the installed ground reference electrode or ground rods. Verify that they are intact and accessible. Measure the ground system at these test points with the clamp-on meter. The results shall be recorded on the Ground Test Point Data Sheet 16000-N as provided in Specification 01331 – Reference Forms.
      c. Digitally Photograph clamp-on meter in place during test and include with test data sheets. Digital images shall have the Serial Key identified for reference. Digital images of these test points with the clamp-on tester in place are to provide a visual representation of the proper clamp-on testing placement and method and shall be inserted into the ground test sheet document.
      d. Install metal ground test point tags identified with the serial key number shown on the DRAWINGS at each test point using stainless steel wire and zinc wire clamps. For any test points within equipment, attach test point tag to exterior of equipment with epoxy.

B. The grounding system maximum resistance shall not exceed twenty five (25) ohms under normally dry conditions when measured by the resistance tester.

C. Test all grounded cables and metal parts for continuity of connection.
D. Install grounding test tags for each grounding test point as shown on Drawings. Provide the following for each tag. Install tag with epoxy if unable to utilize wire and clamp.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Part No.</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Two Part Non-Sag Epoxy</td>
<td></td>
<td>Hardman</td>
</tr>
<tr>
<td>2</td>
<td>Stainless Steel Wire/ 30 ft roll</td>
<td>38091</td>
<td>Brady</td>
</tr>
<tr>
<td>3</td>
<td>Zinc Wire Clamps 50/pk</td>
<td>38090</td>
<td>Brady</td>
</tr>
<tr>
<td>4</td>
<td>Aluminum Tag - Green</td>
<td>49908</td>
<td>Brady</td>
</tr>
</tbody>
</table>

E. Tests shall be witnessed by the ENGINEER and OWNER.

++ END OF SECTION ++
SECTION 16121

CONTROL (INSTRUMENTATION) CABLE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required to furnish and install instrumentation, telephone cables and security system fiber cables.
   2. The types of cable include the following:
      a. Single Conductor Control Cable
      b. Shielded Cable
      c. Unshielded Cable
      d. Telephone Cable
      e. Intercom and Paging System Cable
      f. Security Cable

1.2 SUBMITTALS

A. Shop Drawings: Submit for approval the following:
   1. Manufacturer's technical information for instrumentation cable proposed for use.
   2. Manufacturer's technical information for telephone cable and underground splicing for approval by the City of Phoenix, Information Technology Department.

PART 2 - PRODUCTS

2.1 MATERIALS

A. 120 Volt or less Single Conductor Control Cables see Section 16122.2.1.A

B. Single Shielded Pair Cable:
   1. Tinned copper, nineteen strand, PVC insulated conductors, No. 16 AWG minimum, twisted with aluminum-polyester shield, stranded tinned 16 AWG copper drain wire and PVC black or gray outer jacket. Wire conductor colors shall be black (-neg) and red (+pos). 600 Volt Tray Cable (TC) rated.
   2. Product and Manufacturer: Provide one of the following:
      a. Belden Company (No. 9342).
      b. Okonite Company.
      c. Dekoron Wire and Cable Company.
C. Multipaired Shielded Cable:
   1. To be utilized only for wiring between Remote Terminal Units and Intermediate
      Terminal Panels as shown on drawings.
   2. Bare, soft annealed copper, seven strand, tinned copper conductors, PVC
      insulated conductors, No. 16 AWG minimum, twisted in pairs with aluminum-
      mylar shield over each pair, tray cable rated, silicone rubber fiberglass fire
      barrier tape, tinned copper drain wire, pairs shall be individually numbered,
      aluminum mylar overall shield, PVC outer jacket. Color shall be black and red.
      Rated for 600 volts. Multi conductor cable shall only be utilized in cable tray
      applications or unless specified on drawings.
   3. For control circuits provide a minimum number of spare conductors per cable
   4. Product and Manufacturer: Provide one of the following:
      a. Belden, No. 1043B.
      b. Or equal.

D. Multipaired Unshielded Cable:
   1. To be utilized only for wiring between Remote Terminal Units and Intermediate
      Terminal Panels as shown on drawings.
   2. Tinned copper conductors, No. 16 AWG seven strand, PVC insulated, 16
      twisted pairs. Rated for 600 volt. Conductor colors shall be black and white.
      Overall Shield with 100 percent coverage and tinned copper drain wire. Jacket
      shall be PVC and UL Type TC. Multi conductor cable shall only be utilized in
      cable tray applications or unless specified on drawings.
   3. Product and Manufacturer: Provide one of the following:
      a. Belden, No. 1073B.
      b. Or equal.

E. Telephone Cable:
   1. Bare, solid annealed copper, No. 22 AWG twisted pairs with solid polyolefin
      insulation, color coded to telephone industry standards. Cable core shall be
      filled with a waterproofing compound and wrapped with a non-hygrosopic
      core tape. Shielding shall be constructed of 0.005-inch solid copper. Cable shall
      be finished with a black polyethylene jacket. Cable shall contain the number of
      pairs as shown on the Drawings.
   2. Product and Manufacturer: Provide one of the following:
      a. Anixter.
      b. Or equal.

F. Intercom and Paging System Cable:
   1. Cable for the connection of the remote staff stations associated with the
      intercom or paging system shall be single pair shielded audio and data cable
      insulated for 600 volt, as manufactured by Belden, No. 8719, Mohawk
      equivalent, or equal.
2. Where paging system cables are shown on the Drawings, two single pairs of the specified cable shall be installed in the indicated conduit, one shall serve as a spare.

3. Product and Manufacturer: Provide one of the following:
   b. Mohawk.
   c. Or equal.

G. Cable Terminals:
   1. Provide ferule compression fittings or UL listed fork type copper compression terminals with nylon insulation for termination of cable at all terminal blocks.
   2. For Panels provided under 17260, see Section 17260 - Field Wire Termination for termination methods, product and manufacturer.

   Product and Manufacturer: Provide one of the following:
   a. T&B Sta-Kon.
   b. Burndy Insulug.

H. Cable/Wire Markers:
   1. Provide only heat shrinkage type cable/wire identification, which shall be typewritten.
   2. Wire number shall include the conduit number and be a consecutive number based on the number of wires in a conduit, starting with number 1; example C18J – 1, where as C18J is the conduit number and 1 is the first wire. If ten wires are in a conduit, the numbering would be C18J-1 through C18J-10. No two wires are to have the same number.
   3. Product and Manufacturer: Provide the following:
      a. W.H. Brady Company. (Part # PSPT-187 for a single conductor)
      b. W.H. Brady Company. (Part # PSPT-500-1W for a twisted pair shielded cable)
      c. Or equal

PART 3 - EXECUTION

3.1 INSTALLATION

A. Separation Requirements:

   1) Instrumentation Cables shall not be installed within the same conduits, raceways or cable trays with cables identified in Sections 16122, 16123 and 16124.

   2) Telephone Cables are to be routed separately from other cables.

   3) Intercom and Paging System Cables are to be routed separately from other cables.
4) Fire Detection or Protection System Cables are to be routed separately from other cables.

5) Security System Cables are to be routed separately from other cables unless noted on the drawings.

6) Additional separation requirements:

   a) Class 1 Control circuits (limited to 120 V, see NEC Section 725 Parts I & II for Class 1 Circuits) are to be routed separately from other cables. (Lights and starter circuits)

   b) Class 2 Control circuits (limited current and less than 50 V, see NEC Section 725 Parts I & III for Class 2 Circuits) are to be routed separately from other cables. (Analog signal, digital communications, Discrete Inputs and Outputs)

   c) Class 3 Control circuits (limited current and less than 120 V, see NEC Section 725 Parts I & III for Class 3 Circuits) are to be routed separately from other cables. (Discrete Inputs to and Outputs from OPTO 22 modules to or from contacts and interposing relay coils.)

B. Install all cables complete with proper identification and terminations at both ends. Cable outer installation shall be dressed at the end of the cables with heat shrink tubing prior to terminations. Utilizing electrical tape is not allowed for dressing.

C. Ground shield of shielded cables at one end only and as recommended by instrument manufacturer. When multiple shielded cables are terminated on a designated analog terminal strip an insulated green with yellow strip wire is used to jumper between the shield terminals and at the end of the terminal strip terminate the shields to the isolated DC ground bar mounted in the panel.

D. Terminate stranded conductors with pre-insulated crimp type spade or barrel compression fitting terminals properly sized to fit fastening device and wire size.

E. Install and terminate vendor furnished cable in accordance with vendor equipment requirements.

F. Coordinate the installation and termination of the telephone cables with the City of Phoenix, Information Technology Department.

G. Install in conformance with the National Electrical Code and the City of Phoenix Electrical Code.
H. Identification:
   1. Each cable and conductor shall be identified in each pull box and manhole with
      identification markers, which shall include the conduit number and/or cable
      number. The markers shall be self-laminating vinyl on white background and
      shall be printed using a Brady "XC Plus" printer or equal.

3.2 TESTING

A. Test all 600 volt wiring in accordance with the requirements of Section 16122, 600
   Volt Cable.

B. Test shielded instrumentation cable shields with an ohmmeter for continuity along
   the full length of the cable and for shield continuity to ground. The tests shall be
   witness by the OWNER and ENGINEER.

C. Connect shielded instrumentation cables to a calibrated 4 to 20 mADC signal
   transmitter and receiver. Test at 4, 12 and 20 milliamp transmitter settings.

D. Telephone cables shall be tested in accordance with and in the presence of the City of
   Phoenix, Information Technology Department. A written proposed schedule shall
   be submitted a minimum of seven days prior to the testing of each telephone cable
   for inspection coordination.

++ END OF SECTION ++
PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment and incidentals as shown on the
      Drawings, specified and required to furnish and install 600 volt cable.
   2. The types of cable required include the following:
      a. Insulated cable for installation in raceways.
      b. Cable for installation in trays.
      c. Direct burial cable.
      d. Direct burial cable duct.

1.2 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: Comply with applicable provisions of
   Regulatory Agencies below and others having jurisdiction:
   1. Codes: Install cable in accordance with the Phoenix Electrical Code and
      applicable local codes.
   2. Tests by Independent Regulatory Agencies: Cable shall bear the label of the
      Underwriters' Laboratories, Inc.

B. Reference Standards: Comply with applicable provisions and recommendations of
   the following, except where otherwise shown or specified:
   1. ASTM B 3, Soft or Annealed Copper Wire.
   2. ASTM B 8, Concentric-Lay-Stranded Copper Conductors, Hard, Medium-hard
      or Soft.
   3. ICEA S-66-524, Cross-linked-thermosetting- polyethylene-insulated Wire and
      Cable for the Transmission and Distribution of Electrical Energy.
   5. City of Phoenix – Amendments to the National Electrical Code.
   8. IEEE Standard 971.

C. Factory Production Tests:
   1. All wire and cable shall be factory tested in accordance with the requirements of
      Underwriters' Laboratories.
1.3 SUBMITTALS

A. Shop Drawings: Submit for approval the following:
   1. Manufacturer's literature, specifications, and engineering data for 600 volt insulated cable proposed for use.
   2. Manufacturer's literature for cable markers.

B. Test Records: Submit for review copies of written records of field insulation resistance test results.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Insulated Cable In Raceways:
   1. Material: Single conductor copper cable conforming to ASTM B 3 and B 8 with flame-retardant, moisture and heat resistant cross-linked polyethylene or thermoplastic insulation rated 90°C in dry locations and 75°C in wet locations and listed by UL as Type XHHW-2. Multi conductor cable shall only be utilized in cable tray applications or unless specified on drawings.
   2. Application: Use Type XHHW-2 for all sizes, unless otherwise indicated.
   3. Wire Sizes: Not smaller than No. 12 AWG for power and lighting and No. 14 AWG for 120 volt control circuits
   4. Stranding: All 600 volt cable shall be stranded.
   5. Product and Manufacturer: Provide one of the following:
      a. Okonite Company
      b. Encore Wire Corporation
      c. The Southwire Company
      d. Service Wire Company
      e. General Cable

B. Cable for Installation in Trays:
   1. Material: Factory assembled cable, multi-conductor as required by the Drawings, Type XHHW-2 bearing the UL label, Type TC and specifically approved for installation in cable trays and meeting the flame test requirements of IEEE 1202.
   2. For control circuits provide a minimum number of spare conductors per cable
   3. Product and Manufacturer: Provide one of the following:
      a. The Southwire Company.
      b. The Okonite Company.
      c. Service Wire
C. Direct Burial Cable:
   1. Single or multiconductor, stranded copper conductors, 60-mils butadiene styrene or ethylene propylene insulation, overall jacket of neoprene or PVC. Rated at 600 volts.
   2. Product and Manufacturer: Provide one of the following:
      a. The Okonite Company.

D. Direct Burial Cable Duct:
   1. Material: Multi conductor stranded copper cables; 600 volt cross-linked polyethylene insulated, factory assembled in a coilable, medium density polyethylene duct suitable for direct burial in earth for operation at a maximum conductor temperature of 90°C.
   2. Product and Manufacturer: Provide one of the following:
      a. Cablecon by Integral Corporation.
      b. Tamaqua Duct System by Tamaqua Cable Products Corporation.

E. Cable Connectors, Solderless Type:
   1. For wire sizes up to and including No. 6 AWG, use compression type. Alarm and control wire shall be terminated using forked type connectors at terminals. If terminal block is crimp type, then the wire shall be terminated with a crimped ferrule or solder dipped.
   2. Product and Manufacturer: Provide one of the following:
      a. Phoenix Contact – Clipline
      b. Thomas & Betts
      c. Weidmuller
      b. Burndy Hylug.
   3. For wire sizes No. 4 AWG and above, use either compression type or bolted type with tinned-plated contact faces.
   4. For wire sizes No. 250 kcmil and larger, use connectors with at least two cable clamping elements or compression indents and provision for at least two bolts for joining to apparatus terminal.
   5. Properly size connectors to fit fastening device and wire size.

F. Cable Splices:
   1. For wire sizes No. 8 AWG and larger, splices shall be made up with compression type copper splice fittings. Splices shall be taped and covered with materials recommended by the cable manufacturers, to provide insulation equal to that on the conductors.
   2. For wire sizes No. 10 AWG and smaller, splices may be made up with preinsulated spring connectors.
   3. For wet locations, splices shall be waterproofed. Compression type splices shall be waterproofed by a sealant-filled, thick wall, heat shrinkable, thermosetting
tubing or by pouring a thermosetting resin into a mold that surrounds the joined conductor. Spring connector splices shall be waterproofed with a sealant-filler.

4. Product and Manufacturer: Provide one of the following:
   a. Compression-Type Splices:
      1) Burndy Hylink.
      2) T&B Color-Keyed Compression Connectors.
   b. Spring Connectors:
      1) Buchanan B-Cap.
      2) T&B Wire Connector.

G. Cable/Wire Markers:
   1. Provide only heat shrinkage type cable/wire identification, which shall be type-written.
   2. Wire number shall include the conduit number and be a consecutive number based on the number of wires in a conduit, starting with number 1; example C18J – 1, where as C18J is the conduit number and 1 is the first wire. If ten wires are in a conduit, the numbering would be C18J-1 through C18J-10. No two wires are to have the same number.
   3. Product and Manufacturer: Provide the following:
      a. By W.H. Brady Company. (Part # PSPT-187 for a single conductor)
      b. Or Approved Equal

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all cables complete with proper identification and terminations at both ends. Check and correct for proper phase sequence and proper motor rotation.

B. Pulling:
   1. Use insulating types of pulling compounds containing no mineral oil.
   2. Pulling tension shall be within the limits recommended by the wire and cable manufacturer.
   3. Use a dynamometer where mechanical means are used.
   4. Cut off section subject to mechanical means.

C. Bending Radius: Limit to a minimum of six times cable overall diameter.

D. Slack: Provide maximum slack at all terminal points.

E. Splices:
1. Where possible, install cable continuous, without splice, from termination to termination.

2. Where required, splice where shown on the Drawings or as approved by the ENGINEER and also where required for cable installation. All splices below grade, in manholes, handholes and wet locations shall be waterproofed.

3. Splices are not allowed in conduits.

4. All splices shall be pre-approved by ENGINEER.

F. Identification:
1. Each cable and conductor shall be identified in each pull box and manhole with identification markers, which shall include the conduit number and/or cable number. The markers shall be self-laminating vinyl on white background and shall be printed using a Brady "Tagus T300" printer or equal.

G. Phase Identification/Color Coding:
1. All three phase circuits shall be identified, which shall include the conduit number and phase, at switchgear, motor control centers, manholes (5 KV), cables and panelboards as "PHASE A", "PHASE B", and "PHASE C". All conductors not identified with a tag number shall be identified with a tag indicating the source.

2. Three phase 480 volt systems shall be color coded as follows:
   a. Phase A - Brown.
   b. Phase B - Orange.
   c. Phase C - Yellow.
   d. Neutral (if applicable) - White.

3. Single phase, 120/240 volt circuits shall be color coded as follows:
   a. Phase A - Black.
   b. Phase B - Red.
   c. Neutral - White.

4. Three phase, 208 volt systems shall be color coded as follows:
   a. Phase A - Black.
   b. Phase B - Red.
   c. Phase C - Blue.
   d. Neutral - White.

5. No. 6 AWG and Smaller: Provide colored conductors.

6. No. 4 AWG and Larger: Apply general purpose, flame retardant tape at each end, wrapped in overlapping turns to cover an area of at least 2-inches.

7. All field wiring color shall be black unless otherwise noted.

3.2 TESTING

A. Test each electrical circuit after permanent cables are in place to demonstrate that the circuit and connected equipment perform satisfactorily and that they are free from improper grounds and short circuits.
B. Individually test 600 volt cable mechanical connections after installation and before they are put in service with a calibrated torque wrench. Values shall be in accordance with manufacturers’ recommendations.

C. Individually test 600 volt cables for insulation resistance between phases and from each phase to ground. Test after cables are installed and before they are put in service with a Megger whose rating is suitable for the tested circuit. Tests shall meet with the applicable specifications of IPCEA S-66-524 and NEMA WC7-1971. Tests shall be witnessed by the ENGINEER.

D. The insulation resistance for any given conductor shall not be less than the value recommended by the IPCEA or a minimum of one megohm for 600 volt and less service, if not IPCEA listed. Any cable not conforming to the recommended value or which fails when tested under full load conditions shall be replaced with a new cable for the full length.

E. Install in accordance with the National Electrical Code and the City of Phoenix Electrical Code.

F. Where existing cables are spliced to cables provided under this Contract, the existing cables shall be tested prior to splicing. Test cables at 1,000 volts DC for one minute. The entire spliced cable installation shall be re-tested after the splice is completed. Any existing cable which fails or has a value less than two megohms shall be brought to the ENGINEER’S attention and the splicing shall not proceed. Tests shall be witnessed by the ENGINEER.

++ END OF SECTION ++
SECTION 16131

PVC COATED RIGID METAL CONDUIT, RIGID NONMETALLIC CONDUIT,
ELECTRICAL METALLIC TUBING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
1. Provide all labor, materials, equipment and incidentals as shown on the
Drawings, specified and required to furnish and install conduit and fittings
to provide complete, coordinated and grounded raceway systems.
2. Conduit routings for various systems within buildings and other areas may
not be shown on the Drawings. Responsibility to establish single line, riser
and interconnection diagrams and any other related information shown on
the Drawings, belongs to CONTRACTOR. Provide for the proper
installation of all conduits for each system. Submit conduit routing and
tagging meeting all specifications of Submittals Section 1.3-A and Section
2.1-G below to Engineer/Owner for review and approval prior to
construction.
3. The following types and installation methods shall conform to the
following:
   a. Polyvinyl Chloride (PVC) Coated Rigid Metal Conduit (NEC Article
      344)
      1) Corrosive areas.
      2) For exposed indoor conduit runs.
      3) For exposed conduit runs in all outdoor areas.
      4) For all underground bends (horizontal and vertical) in duct banks
         that are 45° or more.
      5) For non-encased underground conduit.
      6) (--) For VFD to motor runs.
      7) For conduit lighting runs for single conduits non-encased (an
         alternative to Rigid Nonmetallic Conduit (RNC) encased)
   b. Rigid Nonmetallic Conduit (RNC): Schedule 40 PVC conduit. (NEC
      Article 352)
      1) For masonry walls.
      2) For concrete encased duct bank runs.
      3) For conduits embedded in structural concrete slabs.
      4) For under structural slabs.
   c. Electrical Metallic Tubing (EMT) (NEC Article 358):
      1) For metal stud walls where shown on CONTRACT DRAWINGS.
      2) For above ceilings where shown on CONTRACT DRAWINGS.
3) EMT is not to be used in buildings which have PVC coated rigid metal conduit systems.

B. Coordination:
1. Conduit runs shown are diagrammatic. Coordinate conduit installation with piping, ductwork, lighting fixtures and other systems and equipment and locate so as to avoid interferences.
2. For conduits to be embedded in concrete slabs, confirm adequate slab thickness and coordinate location of conduits with placement of reinforcing steel, water stops and expansion joints.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified.
1. National Electrical Code (NEC) current adoption.
2. UL Standard No. 6, Rigid Metal Electrical Conduit.
3. UL Standard No. 651, Schedule 40 and 80 PVC Conduit.
4. ANSI C80.4, Fittings for Rigid Metal Conduit and Electrical Metal Tubing
5. NEMA TC2, Electrical Plastic Tubing, Conduit and Fittings.
6. NEMA TC3, PVC Fittings for Use with Rigid PVC Conduit and Tubing.
7. NEMA RN 1, Polyvinyl Chloride (PVC) Externally Coated Rigid Metal Conduit and Intermediate Metal Conduit
8. TIA-569-B, Commercial Building Standard for Telecommunications Pathways and Spaces

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval the following:
1. Manufacturer’s catalog cuts for the conduit, fittings, supports, conduit identification tags, orange electrical ID tape, and warning ribbon proposed for use. Provide engraved samples of conduit identification tags.
2. Construction details of conduit racks and other conduit support systems.
3. Layout drawings showing proposed routing of exposed conduits, conduits embedded in structural concrete and conduits directly buried in earth. Drawings shall show locations of intermediate termination panels (ITP’s), pull boxes and penetrations in walls and floor slabs. Drawings of embedded conduits shall include cross-sections showing the thickness of the concrete slabs and the locations of conduits with respect to reinforcing steel and waterstops. Tag conduits per conduit schedule shown on drawings.
4. Drawing shall be electronically produced to maintain quality and clarity of presentation when re-produced, even when reduced to half size (11” x 17”).
5. Provide manufacturer’s proof of certification for PVC coated rigid metal conduit for all installer’s supervisors.
B. Record Drawings: Show the actual routing of exposed and concealed conduit runs on the Record Drawings conforming to the requirements of Section 01782-1.1, Record Documents.

PART 2 – PRODUCTS

2.1 MATERIALS - CONDUIT AND CONDUIT FITTINGS

A. PVC Coated Rigid Metal Conduit:
   1. Conduit, Elbows and Couplings:
      a. Material: Rigid, heavy wall, mild steel, interior coating of 2-mil thick urethane, tapered threads, carefully reamed ends, 3/4-inch NPS minimum size for exposed, 1 inch for embedded, encased, or otherwise inaccessible, with a factory exterior coating of 40-mil thick polyvinyl chloride.
      b. Color: All PVC coated materials shall be standard dark gray.
      c. Tools: Power drives, chucks, z-wrenches, vises, and cutting or bending tools shall follow recommendations for tooling in manufacturer’s installation guide. Use touch-up compounds recommended by the manufacturer for repair of minor damage to interior urethane or exterior PVC factory coatings.
      d. Manufacturer: Provide conduit and fittings of one of the following:
         1) Robroy Industries, “Perma-Cote”.
         2) Robroy Industries, “Plasti-Bond”.
         3) OCAL Inc.
   2. Fittings and Outlet Bodies:
      a. Material and Construction: Cast gray iron alloy, cast malleable iron bodies and covers with a factory coating of 40-mil thick polyvinyl chloride, an interior coating of 2-mil thick urethane and Form 7 tongue-in-groove V-seal gasket on sizes ½” through 2”. Conduit or fittings having areas with thin or no coating shall be unacceptable. Do not use "LB" fittings for conduit sizes of 1¼” or larger. Use type "LBD" fittings wherever the use of fittings for conduit sizes of 1¼” or larger is unavoidable. All units shall be threaded type with five full threads. Material shall conform to ANSI C80.4.
      b. Use: Provide conduit fittings and outlet bodies in all corrosive locations.
      c. Manufacturer: Provide PVC coated conduit fittings and outlet bodies of one of the following:
         1) Robroy Industries, “Perma-Cote”.
         2) Robroy Industries, “Plasti-Bond”.
         3) OCAL Inc.
   3. Conduit Hubs:
      a. Material: Threaded conduit hub, vibration proof, weatherproof with captive O-ring seal, zinc metal with insulated throat and factory coating of 40-mil thick polyvinyl chloride and smooth urethane interior coating.
b. Use: Provide for all PVC coated conduit terminations to boxes, cabinets and other enclosures located in all areas.

c. Locknuts are not allowed. Use hubs only.

d. Manufacturer: Provide one of the following:
   1) Robroy Industries, “Perma-Cote”.
   2) Robroy Industries, “Plasti-Bond”.
   3) OCAL Inc.

B Rigid Nonmetallic Conduit:
1. PVC Plastic Conduit:
   a. Conduit Material: Schedule 40 PVC plastic, 90°C rated, conforming to NEMA TC-2 and UL No. 651.
   b. Fittings: Elbows, bodies, terminations, expansions and fasteners of same material and manufacturer as base conduit. Materials shall conform to NEMA TC-3 and UL No 514.
   c. Provide cement and primer by same manufacturer as base conduit.
   d. Manufacturer: Provide conduit and fittings of one of the following:
      1) PW Eagle
      2) Prime Electrical Products
      3) Cantex

C. Electrical Metallic Tubing:
1. Elbows, Fittings, and Couplings:
   b. Couplings and connections: Compression or threaded type only. Set screw type shall not be permitted.
   c. Elbows: Factory formed of same material specified for EMT conduit.
   d. Certifications: Material shall conform to UL-797, ANSI C80.3. Conduit, elbows, couplings, etc. shall bear UL listing and manufacturer’s name.
   e. Use of EMT type raceway systems shall only be permitted where specified in Paragraph 1.1.A.4.c, above.
   f. Manufacturer: Provide EMT conduit, elbows, fittings and couplings of one of the following:
      1) Allied Tube and Conduit.
      2) LTV Steel Tubular Products Company.
      c) Wheatland Tube Company.

2.2 MATERIALS - MISCELLANEOUS FITTINGS

A. Conduit Bushings:
1. Insulated Bushings: Malleable iron body with plastic liner, threaded type with steel clamping screw. Provide with bronze grounding lug, as required.
2. Use: Provide for all conduit terminations to boxes, cabinets, other enclosures and raceways not requiring a hub.
3. Manufacturer: Provide one of the following:
   a. O-Z/Gedney.
   b. Appleton Electric Company.
   c. Thomas and Betts.

B. Conduit Tags:
   1. Tag all conduits at the ends and in all intermediate boxes, chambers, hand holes and other enclosures.

2. Conduit tags shall be yellow, 1-1/2-inch diameter, round, aluminum tags, laser engraved or standard engraving with the conduit number as shown on the Conduit and Cable Schedule. Punched or stamped lettering is not allowed. Font shall be 1/4-inch Arial or Helvetica. The conduit tags shall be manufactured by Brady, Catalog No. 49900, Or Equal.

3. Each tag shall be attached with nylon-coated 48-mil stainless steel wire and fasteners, as manufactured by Brady, Catalog No. 38091, and zinc wire clamps, double ferrule design, as manufactured by Brady Catalog No. 38090 to secure the stainless steel wire. Where this method is not practical, fasten to the adjacent masonry by means of expansion bolts.

C. Warning Ribbon:
   1. Over all underground duct banks and direct cables, install warning ribbon approximately 12-inches below finished grade and centered on direct buried cables, electrical ductbanks and conduits without ductbank encasement. Provide 6-inch wide, 4-mil thickness underground metallic-lined marking tape with red polyethylene film on top and with clear polyethylene film on the bottom. The tape shall be permanently imprinted with "CAUTION BURIED ELECTRIC LINE BELOW".

2. Manufacturers: Provide one of the following:
   a. Brady "Identoline"; Services and Materials "Buried Underground Tape"
   b. Somerset (Thomas & Betts) "Protect-A-Line"

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install in conformance of NEC, Articles 344, 352 and 358. Cap all conduits, ducts and raceways during construction to protect from debris entering and blocking the circuit installation.

B. Supports:
   1. Rigidly support conduits by clamps, hangers or strut channels.
   2. Support single conduits by means of one-hole pipe clamps in combination with one-screw back plates, to raise conduits from the support surface.
Support multiple runs of conduits on trapeze type hangers with Type 316 Stainless Steel horizontal members and Type 316 Stainless Steel threaded hanger rods, Kindorff or equal. Rods shall be not less than 3/8-inch diameter.

3. PVC coated rigid metal conduit runs, beam clamps, U-bolts, pipe straps, clamp back spacers, clamp hangers and supports shall have a factory applied PVC coating or be stainless steel. Hardware shall be Type 316 Stainless Steel.

4. Right angle beam clamps and U bolts shall be specially formed and sized to snugly fit the outside diameter of the coated conduit.

C. Fastenings: Fasten raceway systems rigidly and neatly to supporting structures by the following methods:
   1. To Wood: Type 316 Stainless Steel wood screws.
   2. To Hollow Masonry Units: Type 316 Stainless Steel toggle bolts.
   3. To Brick Masonry: Type 316 Stainless Steel Price expansion bolts, or equal.
   4. To Concrete: Refer to spec section 05051.
   5. To Steel: Type 316 stainless steel welded threaded studs, beam clamps or bolts with lock-washers or locknuts.

D. PVC Coated Rigid Metal Exposed Conduit:
   1. Install in strict accordance with manufacturer’s recommendations and installation manual. Installers shall be certified by the manufacturer before installation begins.
   2. Install with manufacturer’s installation tools and compounds to prevent damage to the PVC coating.
   3. Repair minor damage to interior urethane and exterior PVC coating with manufacturers recommended touch-up compound.
   4. Install parallel or perpendicular to structural members or walls.
   5. Wherever possible, run in groups. Provide conduit racks of suitable width, length and height and arranged to suit field conditions. Provide support at manufacturer’s recommended distances, or at every ten feet minimum.
   6. Install on structural members in protected locations.
   7. Locate clear of interferences.
   8. Maintain 6-inches from hot fluid lines and 1/4-inch from walls.
   9. Install vertical runs plumb. Unsecured drop length not to exceed 12 feet.
   10. Provide necessary reducers where equipment furnished cannot accept 3/4-inch conduit.

E. Conduit Embedded in Structural Concrete:
   1. Separation: Three times outer diameter of larger conduit center to center.
   2. Minimum Slab Thickness: Confirm that concrete slab thickness is sufficient for embedding conduits.
a. For embedding conduit sizes up to 1-1/2 inches, the minimum slab thickness shall be 7-inches plus the outer diameter of the conduit or conduits, where conduits cross.

b. For embedding conduits larger than 1-1/2 inches, the minimum slab thickness shall be five times the outer diameter of the conduit where conduits do not cross and six times the outer diameter of the larger conduit where conduits do cross.

3. Concrete shall have a minimum 28-day compressive strength of 2,000 PSI. Concrete used for ductbanks shall be Class E with red color added as specified in “Cast-in-Place Concrete” Section 03300.

4. Run conduits in center of slab, where applicable.

5. Run conduits in spacers to maintain recommended minimum, even spacing.

6. Run conduits above waterstops.

7. Before concrete is placed, make the necessary location measurements of the conduits to be embedded so that the information is available to prepare Record Drawings.

8. All conduits entering or exiting concrete shall be PVC coated galvanized rigid metal, for a minimum of 12-inches from the concrete edge.

F. Underground Conduits that are non-encased: PVC coated rigid metal conduits.

1. Install individual underground conduits a minimum of 24-inches below grade, unless otherwise shown on the Drawings or as required to avoid existing obstructions.

2. Perform all excavation, bedding, backfilling and surface restoration including pavement replacement, where required.

3. Install warning ribbon 12-inches below finished grade over all conduits.

4. Make conduit connections watertight by applying PVC touch-up compound at the sealing sleeve joints.

G. Empty Conduits:

1. Spare conduits shall be cleaned, swabbed, and mandreled to verify viability for future use.

2. Install a true tape or mule tape in each empty conduit and cap conduits not terminating in boxes with permanent fittings designed for the purpose. Pulling rope or tape shall be constructed of polyester and factory lubricated. Nylon is not allowed.

3. Identify each empty conduit with a conduit tag conforming to the requirements of Paragraph 2.1.G., above, showing the conduit number shown on the Drawings.

H. Field Bends: Use manufacturer supplied field bends whenever possible. No indentations. Diameter of conduit shall not vary more than 15 percent at any bend. Maximum total amount of bends shall not exceed 270°. Length of run between manholes shall be limited to:

1. 300 feet with 270° in bends.

2. 600 feet with 180° in bends.
3. 1000 feet with 90° in bends.

I. Joints:
   1. Make joints tight and ground thoroughly.
   2. Use standard tapered pipe threads for conduit and fittings.
   3. Cut conduit ends square and ream to prevent damage to wire and cable.
   4. Use a degreasing spray to thoroughly clean field cut threads, and internal reams to insure the touch-up compound will adhere to the unprotected metal.
   5. Apply urethane touch-up compound to all joints, field cut threads, and internal reams before assembly for corrosion protection and visible identification of proper installation.
   7. During installation, install with manufacturer’s installation tools to prevent damage to PVC coating. Replace conduit with wrench marks.

J. Terminations:
   1. Install threaded hubs. Do not use bushings or locknuts.
   2. Install conduit hubs on conduits entering boxes, enclosures, cabinets or coming through walls

K. Moisture Protection:
   1. Plug or cap conduit ends at time of installation to prevent entrance of moisture or foreign materials.
   2. Make underground and embedded conduit connections water-tight.
   3. Through Wall Seals and Conduit Sealing Bushings: Install for all conduits passing through concrete slabs, floors, walls or concrete block walls.
      a. For conduits and cables in new construction and passing through exterior subsurface walls and exterior concrete walls, use Type WSK and WSCS through wall seals as manufactured by O-Z/Gedney.
      b. For conduits and cables in new construction and passing through concrete floors and floor slabs, use Type FSK and FSCS floor seals, as manufactured by O-Z/Gedney.
      c. For conduits passing through new exterior block walls or through core-drilled holes in existing exterior subsurface walls, exterior concrete walls, floor slabs and roof slabs, use Type CSMI sealing bushing at the inside of the structure and Type CSMC sealing bushing at the outside of the structure. Sealing bushings shall be as manufactured by O-Z/Gedney.
      d. For conduits passing through existing interior concrete walls or floors and interior block walls, provide CSMC or CSMI type sealing bushings as manufactured by O-Z/Gedney.
   4. Drainage: Pay particular attention to drainage for conduit runs. Wherever possible, install conduit runs so as to drain to one end and away from buildings. Avoid pockets or depressions in conduit runs. Where conduits
enter buildings below grade, seal inside of conduit to form a watertight seal around cables to prevent the entry of water into building.

a. Product and Manufacturer: Provide one of the following:
   1) Type DUX - Duct Sealing Compound, as manufactured by O-Z/Gedney
   2) Type FST Foam Sealant, as manufactured by American Polywater Corp

5. Seal all conduit openings within control and instrumentation panels and distribution equipment with Type DUX - Duct Sealing Compound, as manufactured by O-Z/Gedney, to provide a water/bug-tight seal.

a. Product and Manufacturer: Provide one of the following:
   1) Type DUX - Duct Sealing Compound, as manufactured by O-Z/Gedney
   2) Type FST Foam Sealant, as manufactured by American Polywater Corp

L. Corrosion Protection:

1. Conduit Curb:
   a. For conduits routed in concrete slabs or floors and stub-ups through the floor, provide a 2-inch high concrete curb, extending 2-inches from the outer surface of the conduit penetrating the floor, to prevent corrosion. For floor-mounted equipment, the concrete equipment base shall be in lieu of the concrete curb.
   b. Conduit stub-ups shall be a 90 degree PVC coated rigid metal conduit elbow. PVC coated elbow shall extend slightly above the top of the concrete curb or equipment base. Should the elbow not reach this height, provide PVC coated conduit extension to accommodate requirements. Provide PVC coated coupling/fitting for transition from conduit in slab to elbow.
   c. For conduits stubbing up and terminating at equipment enclosure mounted on a concrete equipment base, provide RNC stub-up and bell end.
   d. For conduits stubbing up and extending to boxes, cabinets and other enclosures above the concrete curb in wet and dusty areas provide PVC coated conduit coupling/fitting between the PVC coated elbow and PVC coated rigid metal conduit for transition between the two conduit types.
   e. For conduits stubbing up and extending to boxes, cabinets and other enclosures above the concrete curb or equipment base in corrosive areas, continue the conduit system with PVC coated rigid metal conduit.
   f. Conduit into a protected base or equipment enclosure shall be RNC with RNC bell end.

2. Dissimilar Metals: Take every action to prevent the occurrence of electrolytic action between dissimilar metals

M. Reused Existing Conduits:
1. Pull rag swab through conduits to remove water and to clean conduit prior to installing new cable.
2. Repeat swabbing until all foreign material is removed.
3. Pull mandrel through conduit, if necessary, to remove obstructions.

N. Core drill for individual conduits passing through existing concrete slabs and walls. Obtain authorization from OWNER prior to core drilling. Prior to core drilling, drill sufficient number of small exploratory holes to establish that the area to be core drilled is free of existing embedded conduits. Seal spaces around conduit in accordance with Section 01723, Cutting and Patching, and the wall penetration details as shown on the Drawings.

O. Non-metallic Conduit:
1. Install in accordance with manufacturer’s recommendations.
2. Join sections in accordance with manufacturer’s installation procedures for push-fit, bell and spigot type joints, if applicable, or with manufacturer’s recommended cement and primer.
3. During installation provide expansion fittings for expansion and contraction to compensate for temperature variations. Expansion fittings shall be watertight and of the type suitable for direct burial.
4. Make transition to PVC coated galvanized rigid metal conduit before making turns into enclosures, cabinets, termination boxes, pull boxes, etc.
5. For expansion/deflection fittings as shown on CONTRACT DRAWINGS.

P. Wall Penetrations:
1. CONTRACTOR shall ensure conduits that penetrate walls allow for the maintenance of minimum bend radius during the installation of cable.
2. Submit shop drawings for approval for each wall penetration.

3.2 TESTING

A. Test conduits by pulling through each conduit a cylindrical mandrel not less than two pipe inside diameters long, having an outside diameter equal to 90 percent of the inside diameter of the conduit.

B. All conduits greater than 1.5 inches in size shall be swabbed and mandrel cleaned. This process shall be 100 percent witness inspected and each conduit inspection shall be identified and documented.

++ END OF SECTION ++
SECTION 16132

FLEXIBLE CONDUITS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required to furnish and install flexible metallic conduit and fittings.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified.
   1. Phoenix Electrical Code, Article 351, Liquid-Tight Flexible Metal Conduit.
   2. UL Standard No. 360, Liquid-Tight Flexible Steel Conduit.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval the following:
   1. Manufacturer’s catalog cuts and technical information for flexible conduit and fittings proposed for use.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Flexible Conduit (Non-hazardous Areas):
   1. Material: Flexible galvanized steel core with smooth, abrasion resistant, liquid-tight, polyvinyl chloride cover and color to be black. Continuous copper ground built in for sizes 3/4-inch through 1-1/4-inch. Material shall be UL listed.
   2. Product and Manufacturer: Provide one of the following:
      a. Sealtite UA by Anaconda Metal Hose Division, Anaconda American Brass Company.
      b. Liquatite Type L.A. by Electric-Flex Company.
      c. Or equal.

B. Flexible Conduit (Class 1, Group D, Division 1, Hazardous Areas):

91st Avenue WWTP Sludge Solar Drying Beds 16132-1 08/04/10
1. Material: Flexible brass inner core with bronze outer braid. Steel, brass or bronze end fittings. Minimum of 12-inches in length.
2. Product and Manufacturer: Provide one of the following:
   a. Type ECGJH or ECLK by Crouse Hinds Company.
   b. Type EXGJH or EXLK by Appleton Electric Company.
   c. Or equal.

C. Flexible Conduit Fittings:
1. Material and Construction: Malleable iron with zinc electroplating finish. Fittings shall adapt the conduit to standard threaded connections, shall have an inside diameter not less than that of the corresponding standard conduit size and shall be UL listed.
2. Use: Provide on flexible conduit in non-hazardous and Class 1, Division 2 hazardous areas.
3. Product and Manufacturer: Provide one of the following:
   b. Appleton Electric Company.
   c. Or equal.

D. PVC Coated Conduit Fittings:
1. Material and Construction: Malleable iron with standard finish and 40-mil PVC exterior coating. Fittings shall adapt the conduit to standard threaded connections, shall have an inside diameter not less than that of the corresponding standard conduit size.
2. Use: Provide on flexible conduit in areas designated as corrosive locations.
3. Product and Manufacturer: Provide one of the following:
   a. Robroy Industries.
   b. Permacote Industries.
   c. OCAL Incorporated.
   d. Or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install at motors, transformers and equipment which are subject to vibration or require movement for maintenance purposes. Provide necessary reducer where equipment furnished cannot accept 3/4-inch size flexible conduit. Limit flexible conduit length to three feet maximum.

B. Install in conformance with Phoenix Electrical Code requirements.

++ END OF SECTION ++
SECTION 16144

CONTROL STATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required to furnish and install pushbuttons, selector switches and other control stations.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified.
   3. City of Phoenix – Amendments to the National Electrical Code.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval the following:
   1. Manufacturer's technical information for control stations proposed for use.

B. Control stations shall be furnished in accordance with the requirements as shown on the Drawings, and as specified in Division 17000, Sections 17051, 17052, 17053, and 17226.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Control Stations:
   1. Type: Industrial, heavy duty, oil tight construction with clearly marked Type 316 stainless steel or non-metallic material nameplates identifying equipment controlled.
   2. Enclosures: NEMA 12 for dry indoor locations, NEMA 4X for outdoor and damp, wet or corrosive indoor locations. NEMA 4X stations shall be stainless steel and shall have locking rings, nameplates and all external hardware and components shall be Type 316 stainless steel or non-metallic material.
3. Emergency Stop: Maintained contact type, NEMA A600 contact rating, color red with clearly marked Type 316 stainless steel or non-metallic material nameplate identifying equipment operation, provide as shown on drawings.

4. Pushbuttons: Momentary contact types, NEMA A600 contact rating, with clearly marked Type 316 stainless steel or non-metallic material nameplate identifying equipment operation, provide as shown on drawings.
   a. Stop: Boot color to be red.
   b. Start: Boot color to be black.

5. Selector Switches: Rotary type with round or oval handles and positioning device to securely hold switch in selected position for maintained type and for spring return from left, right, or both to a maintained position with clearly marked Type 316 stainless steel or non-metallic material nameplate identifying equipment operation, provide as shown on drawings.

6. Indicating Lights: 120 VAC, Push-To-Test. Lens color red for running, green for stopped or ready and amber for failure with clearly marked Type 316 stainless steel or non-metallic material nameplate identifying equipment operation, provide as shown on drawings.

7. Product and Manufacturer: Provide control stations of one of the following:
   a. Square D Company.
   b. General Electric Company.
   c. Allen Bradley Company.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount equipment, as shown on the Drawings, so that sufficient access and working space is provided for ready and safe operation and maintenance.

B. Securely fasten equipment to walls or other surfaces on which they are mounted. Provide independent stainless steel or FRP supports where no wall or other surface exists.

C. Install in conformance with Phoenix Electrical Code.

++ END OF SECTION ++
SECTION 16422

COMBINATION MAGNETIC MOTOR STARTERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required to furnish and install combination magnetic motor starters.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified.
   2. NEMA Standard ICS2-321 AC General Purpose Class A Controller for Squirrel Cage Induction Motors, 600 volts and less.
   3. NEMA 250, Enclosures for Electrical Equipment (1,000 volts maximum).
   4. UL Electrical Construction Materials Directory (NLDX).
   6. City of Phoenix – Amendments to the National Electrical Code.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval the following:
   1. Manufacturer’s technical information for combination magnetic motor starters proposed for use.
   2. Listing of the combination magnetic motor starters to be furnished with their location, NEMA size and enclosure type and equipment to be controlled identified.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:
   1. Type: Combination type with magnetic only motor circuit protector. Magnetic coil operated, horsepower rated with thermal overload protection.
2. Enclosures: NEMA 1 for dry, indoor locations and NEMA 4X non-metallic or Type 316 stainless steel for outdoor and damp, wet or corrosive indoor locations.

3. Functional Type: Full voltage, single speed, non-reversing, unless otherwise shown on the Drawings.

4. Control power transformer fused and grounded on low voltage (120 VAC) side for each starter.

5. Auxiliary contacts for motor space heaters, remote status signals and interlocks as shown on the Drawings.

6. Overload Relays:
   a. None

7. Start and stop control stations, selector switches, pilot lights and other devices as shown on the Drawings.

8. Provide factory installed engraved manufacturer’s nameplate identifying the equipment controlled.

B. Product and Manufacturer: Provide one of the following:
   1. Square D Company.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount controller so that sufficient access and working space is provided for safe operation and maintenance.

B. Securely fasten enclosure to wall or other mounting surfaces. Where local wall is not available, provide stainless steel supports to rigidly support equipment reasonably close to motor.

C. Install in conformance with Phoenix Electrical Code.
SECTION 17001

PROCESS CONTROL SYSTEM
GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 SCOPE OF WORK
A. Provide all labor, materials, equipment and incidentals as stated in the specified in the CONTRACT DOCUMENTS and install, calibrate, test, start-up, commission and place in satisfactory operation a complete Process Control System (PCS). PCS shall be as specified by Division 17, Process Controls Sections and all controls systems provided by others in all Divisions as specified on the CONTRACT DOCUMENTS.

B. The PCS is designed to control and monitor equipment operation and information. The unit processes, which the PCS shall control and monitor are shown and described in the CONTRACT DOCUMENTS.

C. EQUIPMENT SUPPLIERS are defined as suppliers or vendors who provide instrumentation, panels, equipment or services that interface with the PCS as specified in Division 17, Process Control System or other Divisions of the CONTRACT DOCUMENTS. EQUIPMENT SUPPLIERS shall coordinate with the PCS COORDINATOR (responsibilities as defined below).

D. CONTRACTOR shall be responsible for all hardware configurations, loop testing of signals, and communications testing for new and modified existing control equipment through the CCS.

E. All control loops shall function as described in Section 17051, Process Control Descriptions or other Divisions and Drawings of the CONTRACT DOCUMENTS.

1.2 QUALITY ASSURANCE
A. General:
1. The CONTRACTOR shall acquire the services of a PCS COORDINATOR for coordination of the furnishing, approval, installation, testing, commissioning, and training for all aspects of the PCS. The PCS COORDINATOR shall be the CONTRACTOR’s representative for all subcontractors providing PCS equipment.

2. CONTRACTOR in conjunction with the PCS COORDINATOR shall be responsible for coordination and supervision of the supply, storage, installation, testing, startup, commissioning and training of all electrical
equipment, instrumentation, panels and services defined in the CONTRACT DOCUMENTS to produce a fully functional PCS.

3. CONTRACTOR in conjunction with the PCS COORDINATOR shall be responsible for proper operation of the PCS with related equipment and materials furnished by other suppliers stated in the CONTRACT DOCUMENTS.

B. PCS COORDINATOR’s Qualifications:
1. Have experience at designing, supplying, installing, testing, start-up and commissioning PCS’s.
2. Have experience in coordinating, reviewing and the handling of equipment submittals.
3. Have experience with integration, implementation and have supported standard lines of digital and analog processing control instrumentation equipment.
4. Have working knowledge in hardware application, data highway systems and computer control systems software programming procedures.
5. Have experience in coordinating or providing standard training course offerings in general process control applications and in operation, programming and maintenance of the control systems and related equipment.
6. Have a thorough working knowledge of waste water treatment processes and control philosophy in accordance with standard practices of the waste water treatment industry.
7. Have thorough knowledge of relevant NEC, OSHA, MIL, NRC, ISA, SAMA, NFPA, UL and API standards and all relevant state and local codes.
8. Have experience in coordinating, reviewing, handling of and presenting equipment operations and maintenance training materials.

C. PCS COORDINATOR’s Responsibilities:
1. General:
   a. Attend the Pre-Construction Conference as required in Section 01301 – Pre-Construction Conference for the presentation of the responsibilities of the PCS COORDINATOR.
   b. Coordinate with the CONTRACTOR in the generation of the Progress Schedule as required in Section 01321 – Progress Schedule (CPM) to incorporate PCS construction activities into the Progress Schedule.
   c. Attend the project Construction Progress Meetings required in Section 01312 – Progress Meetings.
d. Coordinate PCS Progress Meetings as described in Paragraph 1.3 below.

e. Maintain a punch list of items to be completed / corrected for the PCS. Provide an updated copy of this punch list to the ENGINEER at each construction progress meeting.

2. Reviews:

a. Review CONTRACT DOCUMENTS (Specifications, P&ID’s, Process Drawings, Electrical Drawings, Installation Details, etc,) and develop a list of concerns or problems noted for the completion of the complete operating PCS. Submit list to the ENGINEER prior to review of equipment submittals.

b. Coordinate and review all PCS submittals and related equipment submittals in accordance with the CONTRACT DOCUMENTS, prior to submission of submittal to the ENGINEER. Complete Submittal Transmittal Form 01332-A included in Section 01331 – Reference Forms for inclusion with each submittal.

3. Installation:

a. Verify delivery and proper storage of all PCS equipment per the requirements of Sections 01651 - Transportation and Handling of Materials and Equipment and 01661 – Storage of Materials and Equipment. Complete 01661-A - Equipment Delivery Inspection Report included in Section 01331 – Reference Forms for submittal to the ENGINEER.

b. Supervise the installation of the CCS instruments, panels, consoles, cabinets, wiring and other components required.

c. Coordinate with the CONTRACTOR in the development of all Maintenance of Plant Operations plans (MOPO’s) affecting PCS equipment installation or activities as required in Section 01143 – Coordination with Owner’s Operations.

d. Coordinate proper interfacing of CCS hardware, software, field devices and panels, including required interfacing with packaged control systems furnished by other equipment suppliers, and with the plant electrical system.

4. Testing:

a. Coordinate all calibration, testing, start-up and commissioning of the PCS as outlined in the Contract Documents.

b. PCS COORDINATOR shall submit to the ENGINEER a schedule with proposed start dates and test procedure guidelines for start-up, commissioning and field testing at least four weeks in advance of the test start date. Prior to testing each process area, coordinate with the CCS VENDOR to insure that the installation of the CCS software, including any modifications and software configuration testing is completed prior to testing each process area.
c. Complete testing of each process loop through the CCS shall be documented by PCS COORDINATOR as listed in Section 17226 – Process Control System I/O list and submit the signed document to the ENGINEER upon successful completion of tests.

d. Coordinate all testing documentation in accordance with Section 01331, Reference Forms. Maintain a copy of Field Calibration Forms, Loop Test Forms, Equipment Test Reports, Loop Commissioning Forms, Factory Acceptance Test forms and other related forms from Section 01331 – Reference Forms in a single binder for submittal to the ENGINEER to be transmitted to the OWNER at the conclusion of the project.

e. Attend all factory tests required by Division 17 Specifications and other Division Specifications of the CONTRACT DOCUMENTS that are inclusive of the overall PCS.

5. Commissioning and Substantial Completion:

a. Coordinate and provide review comments of all PCS Vendor Equipment Operations and Maintenance Manuals (VEOMM) prior to submission of manual to the ENGINEER. Complete Submittal Review Form 01781-B – Operations & Maintenance Data Review Checklist included in Section 01331 - Reference Forms for inclusion with each VEOMM submittal.

1) Maintain a red-line of the VEOMM ‘s electrical drawings and schematics used during construction to reflect changes or deviations that occur during installation, start-up and commissioning for incorporation into the final VEOMMs. Submit the red-lined electrical drawings and schematics to the provider of the equipment for updates as VEOMM Record Documents for submittal to the ENGINEER to be transmitted to the OWNER prior to Substantial Completion of the project.

b. Maintain red-line ISSUED FOR CONSTRUCTION DRAWINGS used during construction to reflect changes or deviations that occur during installation, start-up and commissioning for incorporation into the final Record Drawings. Submit the red-lined ISSUED FOR CONSTRUCTION DRAWINGS to the ENGINEER prior to Substantial Completion of the project.

c. Coordinate and supervise training of OWNER’S personnel in operation and maintenance of the process control system as required in Division 17 Specifications and other Divisions of the CONTRACT DOCUMENTS as per Section 01821 – Instruction of Operations and Maintenance Personnel.

D. Reference Standards:
1. The following organizations have generated standards that are to be used as guides in assuring quality and reliability of components and systems; govern nomenclature; define parameters of configuration and construction, in addition to specific details in the CONTRACT DOCUMENTS.
   b. API, American Petroleum Institute.
   c. UL, Underwriters’ Laboratories, Inc.
   d. AWWA, American Water Works Association.
   e. Nuclear Regulatory Commission.
   f. NEMA, National Electrical Manufacturers Association.
   g. OSHA, Occupational Safety and Health Administration.
   h. ANSI, American National Standards Institute.
   i. MIL, Military Standards.
   k. SAMA, Scientific Apparatus Manufacturers Association.
   m. IEEE, Institute of Electrical and Electronic Engineers.
   n. NEC, National Electrical Code.
   o. FM, Factory Mutual.
   p. (--1--)

1.3 COORDINATION AND PROGRESS MEETINGS

A. Schedule and coordinate the system installation with regard to all other Work on the site and in accordance with the provisions of the General Conditions. Said coordination shall be documented on the Project Schedule.

B. PCS coordination and progress meetings will be scheduled by the PCS COORDINATOR. The CONTRACTOR, ENGINEER, OWNER and appropriate EQUIPMENT SUPPLIERS shall be required to attend meetings during the time of active work on the PCS. A representative of the CCS VENDOR shall be required to attend meetings during the time of active work on the CCS. PCS COORDINATOR shall provide meeting minutes and updates to the project schedule.
   1. The purpose of the meetings shall be to review the progress of the Work involving the PCS and provide coordination for installation, testing, commissioning, and training of the equipment to ensure that the Project Schedule is met.
   2. Representatives at the meetings shall have the competence and authority to make any and all necessary decisions. Decisions and statements made at the meetings shall commit CONTRACTOR to agreed procedures and schedules.
1.4 SUBMITTALS

A. Shop Drawings:
   1. General:
      a. Shop Drawing submittals are to be in accordance with the requirements of the CONTRACT DOCUMENTS and shall conform to the requirements of Section 01330 - Submittals and as required in other Division 17 Sections.
      b. Manufacture or shipment of the PCS components shall not commence until related submittals have been reviewed by ENGINEER.
      c. Shop Drawings shall be submitted in complete packages grouped to permit review of related items.
      d. Review of Shop Drawings will be for conformance with CONTRACT DOCUMENTS and with regard to functions specified to be provided.
   2. Submittal Requirements:
      a. Product information for all PCS equipment. Include the following:
         1) Manufacturer’s product name and complete model number.
         2) Equipment CMMS Tag and loop number as provided in Section 01630 – Computerized Maintenance Management System Tags and from the CONTRACT DOCUMENTS.
         3) Manufacturer’s data sheets and catalog literature. Provide data sheets as shown in ISA-20-1981. For instruments not included in ISA-20, submit data sheets using a similar format.
         4) Description of construction features.
         5) Performance and operation data.
         6) Installation and mounting details, instructions and recommendations.
         7) Service requirements.
         8) Dimensions.
         9) List of recommended spare parts.
         10) UL/UR Listing Numbers.
         11) Electrical control schematics and field wiring diagrams
         12) Ranges and set points of field and control panel instruments
      b. Control Panel Information:
         1) Control panels shall be furnished in accordance with the requirements as shown on the Drawings and as specified in Division 17000, Sections 17051 – Process Control Descriptions, 17226 – Process Control System I/O List, 17260 – Control Panels, 17262 – Programmable Logic Controller, Software and Programming and Division 16000, Section 16050 – General Conditions.
c. OPTO 22 Cabinets:
   1) OPTO 22 Cabinets shall be furnished in accordance with the
      requirements as shown on the Drawings and as specified in
      Division 17000, Section 17261 – OPTO 22 Cabinets.

B. System Operation and Maintenance Manuals:
   1. Furnish Operations and Maintenance Manuals for the PCS in accordance
      with Section 01781, Operation and Maintenance Data.

C. Report Forms:
   1. 4 copies of the Field Calibration Forms, Loop Test Forms, Equipment
      Test Reports, Loop Commissioning Forms, Factory Acceptance Test
      forms and other related forms from Section 01331 – Reference Forms
      shall be submitted to the PCS COORDINATOR.

1.5 EQUIPMENT DELIVERY, HANDLING AND STORAGE

A. Comply with the requirements of Section 01651, Transportation and Handling
   of Materials and Equipment and Section 01661, Storage of Materials and
   Equipment.

B. All arrangements for transportation, delivery and storage of the equipment and
   materials to be in accordance with the requirements of the CONTRACT
   DOCUMENTS and the requirements of equipment manufacturers.

C. PCS equipment shall be packaged at the factory prior to shipment to protect
   each item from damage during shipment and storage. Containers shall be
   protected against impact, abrasion, corrosion, discoloration or other damages.
   Clearly label contents of each container and provide information on the
   required storage conditions necessary for the equipment. Keep OWNER and
   ENGINEER informed of equipment delivery.

D. All equipment shall be handled and stored in accordance with manufacturer’s
   instructions and relevant organization standards. Equipment shall be protected
   from weather, moisture and other conditions that could cause damage. Items
   that require a controlled environment for storage such as panels and
   microprocessor units shall be stored in a climate controlled warehouse or
   facility. EQUIPMENT SUPPLIER shall notify CONTRACTOR and PCS
   COORDINATOR, in writing, with copies to OWNER and ENGINEER of the
   storage requirements and recommendations for the equipment prior to
   shipment.

E. Provide shop as-built control panel drawings upon delivery of the control panel.
1.6 GENERAL REQUIREMENTS

A. Power Supplies:
   1. All electrically powered equipment and devices shall be suitable for operation on 115-volt 60 Hz power. If a different voltage, a suitable transformer shall be provided if approved by ENGINEER and OWNER.
   2. Appropriate power supplies shall be furnished by CONTRACTOR for all two wire transmitters, loops for monitoring discrete inputs and all necessary outputs.
   3. Power supplies shall be mounted in enclosures and installed in the appropriate control room or field panel.
   4. Design all power supplies for a minimum of 130 percent of the maximum simultaneous current draw.

B. Signal Requirements:
   1. The control system shall be designed to use 4 to 20 mADC analog signals, unless otherwise specified.
   2. Provide signal converters and repeaters, where required. In addition, analog inputs to the computer control system shall be through appropriate repeaters to provide signal isolation where series looped with other devices, and to allow the loop to maintain integrity even if the CCS is out of service. Power supplies shall be sized adequately for signal converter and repeater loads.
   3. Signals shall be isolated from ground.
   4. The system and associated input/output wiring will be used in a plant environment where there can be high energy AC fields, DC control pulses, and varying ground potentials between the sensors/transducers or input contact locations and the system components. The system design shall be adequate to provide proper protection against interferences from all such possible situations.

C. Miscellaneous:
   1. All instrumentation and PCS components shall be heavy-duty types, designed for continuous service in a municipal treatment plant environment. The system shall contain products of a single manufacturer, where possible, and consist of equipment models, which are currently in production. All equipment provided shall be of modular construction and be capable of field expansion through the installation of plug-in circuit cards and additional cabinets as necessary.
   2. Design all logic and control loops to fail-safe. Fail-safe is to protect system if a field wire becomes disconnected.
   3. All field-mounted instruments and PCS components shall be designed for installation in humid and corrosive service conditions. All field mounted instrument enclosures and appurtenances shall conform to NEMA ratings.
listed in Division 16000, Section 16050 – General Requirements, unless otherwise specified.

4. Ranges and scales specified herein shall be coordinated to suit equipment actually furnished.

5. Field-mounted devices shall be protected from exposure to freezing temperatures and shaded from direct sunlight.

D. Environmental Conditions:

1. The control system shall be designed and constructed for continuous operation under the following temperature and humidity conditions:
   a. Control Rooms:
      1) Ambient Temperature: 60°F to 80°F normal range; 40°F to 105°F occasional maximum extremes.
      2) Relative Humidity: 80 percent, normal; 95 percent maximum.
   b. Indoor locations for digital processing equipment hardware, control panels and instruments:
      1) Ambient Temperature: 40°F to 120°F.
      2) Relative Humidity: 98 percent maximum.
   c. Outdoor locations for instruments:
      1) Ambient Temperature: -10°F to 131°F.
      2) Relative Humidity: 100 percent maximum.

E. System Designs:

1. Range, scale and setpoint values specified in other Division 17, Process Control System Sections are for initial setting and configuration. Modifications to these values may be required based on actual equipment furnished and as necessary to implement proper and stable process action and that is determined as systems are placed in operation. These modifications shall be done at no additional cost to OWNER.

2. For any items where ranges, scales and setpoints may not have been specified, CONTRACTOR shall submit a recommendation to ENGINEER for review.

1.7 SYSTEM START-UP, COMMISSIONING AND FIELD TESTING

A. Comply with the requirements of Section 01752 – Equipment and System Start-up and Performance Testing and include the additional requirements:

1. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required to furnish and install all equipment and coordinate all activities required to perform start-up, commissioning and field testing of the Process Control System. Field testing shall include an integrated system field test and operational availability demonstration.
2. Retain the services of the EQUIPMENT SUPPLIERS and CCS VENDOR to supervise and/or perform start-up, commissioning and field testing of all system components. As part of these services, the EQUIPMENT SUPPLIERS shall include for the equipment items not manufactured by the EQUIPMENT SUPPLIER, the services of an authorized manufacturer’s representative to check the equipment installation and place the equipment in operation. The manufacturer’s representative shall be thoroughly knowledgeable about the installation, operation and maintenance of the equipment.

B. System Check-Out and Start-Up

1. With the aid of the EQUIPMENT SUPPLIERS, responsibility belongs to CONTRACTOR to perform the following:
   a. Check and approve the installation of all computer control system components and all cable and wiring connections between the various system components prior to placing the various processes and equipment into operation. Check-out shall include the following items as a minimum:
      1) All wiring shall be checked at each termination point for correct wire size, type, color, termination and wire number.
      2) Analog wiring shall be checked for correct polarity and ground continuity at each termination point in the loop.
      3) All control and monitoring loops shall be checked for signal continuity from source (such as field instrument/equipment, control panel, etc) to end destination.
   b. Conduct a complete system checkout and adjustment, including calibration of all instruments, tuning of control loops, checking operation functions, and testing of final control actions. When there are future operational functions included in this Work, they should be included in the system checkout. All problems encountered shall be promptly corrected to prevent any delays in start-up of the various unit processes.
   c. All instruments and devices shall be checked to verify compliance with the Specifications and approved Shop Drawings.

2. Provide all test equipment required to perform the testing and field calibration of instruments during system checkout and start-up.

3. Furnish to the ENGINEER certified calibration reports provided in Section 01331, Reference Forms for field instruments and devices as soon as calibration is completed. Factory calibrations are not acceptable as a replacement for field calibrations. All instruments must be field calibrated and witnessed by the ENGINEER and OWNER.
a. Receipt of any calibration certificate shall in no way imply acceptance of the work or instrument.
b. Each calibration certificate shall be signed and dated by an authorized representative of CONTRACTOR. Three copies of each completed certificate shall be submitted to ENGINEER.

4. Furnish to the ENGINEER two copies of an installation inspection report 01620-A - Manufacturer’s Installation Certification Form in Section 01331 – Reference Forms certifying that all equipment has been installed correctly and is operating properly. The report shall be signed by authorized representatives of both CONTRACTOR and the EQUIPMENT SUPPLIER.

5. All spare parts must be on-site and accepted prior to commencing integrated system field tests.

C. Commissioning

1. Following the Process Control System checkout and initial operation, CONTRACTOR, with the aid of the EQUIPMENT SUPPLIERS and CCS VENDOR, perform a complete system test in the presence of the ENGINEER to verify that all equipment is operating properly as a fully integrated system, and that the intended monitoring and control functions are fully implemented and operational.
   a. Commissioning can only begin when all instruments and control panels are installed and wired. Operation and Maintenance manuals and a schedule for training must be approved prior to Commissioning.
   b. All spare parts must be on-site and accepted prior to Commissioning.
   c. Submit to the ENGINEER a schedule for Commissioning, including a proposed start date and Commissioning test sheet examples at least three weeks in advance.

2. Commissioning shall exercise field signals between field equipment or instrumentation and each Input/Output Panel though the CCS’s workstation graphic display. As a minimum, perform the following checks for each test:
   a. All wiring shall be checked at each termination point for correct wire size, type, color, termination and wire number.
   b. All instruments and devices shall be checked to verify compliance with the Specifications and approved Shop Drawings. The calibration of analog devices shall be verified including the zero and span.
   c. Analog wiring shall be checked for correct polarity and ground continuity at each termination point in the loop.
d. All analog loops shall be verified at each termination point at 0%, 25%, 50%, 75% and 100% signal levels.

3. Provide the following documentation for use during the Commissioning effort.
   a. Complete panel schematic and internal point-to-point wiring interconnect drawings.
   b. Complete electrical control schematics.
   c. Complete panel layout drawings.
   d. Complete field wiring diagrams.
   e. Complete instrument loop diagrams.
   f. Completed calibration certificates for all field and panel devices which require adjustment and/or calibration.
   e. Provide one set of Commissioning documentation for the OWNER'S personnel, one set for the ENGINEER'S use, one set for field use, and the required number of sets for CONTRACTOR'S use.

4. The Drawings corrected and modified during Commissioning shall form the basis for the "As-Built" Record Drawing requirement as specified in this Section.

5. Any defects or problems found during the Commissioning effort shall be corrected by CONTRACTOR and then retested to demonstrate proper operation.

D. Integrated System Field Test
   1. Following the completion of Process Control System checkout and initial operation and CCS software testing the CONTRACTOR, with the aid of the EQUIPMENT SUPPLIER and CCS VENDOR, shall remain on-site and be available during this period to correct instrumentation and control system hardware problems. The integrated field test shall be performed to verify all equipment/instrumentation is operating properly as a fully integrated system with the CCS, and that the intended monitoring and control functions are fully implemented and operational.

   2. Following software testing and demonstration of all system functions, the Process Control System including field sensors/transducers and instruments shall be running and fully operational for a continuous 48 hour period. The Operational Availability Demonstration specified below shall not begin until the continuous 48 hour integrated system test has been successfully completed and OWNER and ENGINEER agree that the Operation Availability Demonstration can begin.

   3. Any defects or problems found with the instrumentation, control system hardware, control panel components/wiring and field devices during the integrated field testing effort shall be corrected by CONTRACTOR and then retested to demonstrate proper operation.
1.8 PROCESS CONTROL SYSTEM TRAINING

A. Requirements and Responsibilities
1. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required to perform and coordinate all required training at times acceptable to OWNER and ENGINEER.
2. Retain the services of all PCS EQUIPMENT SUPPLIERS to provide operation and maintenance training for all Process Control System equipment as specified herein.
3. For equipment items not manufactured by the EQUIPMENT SUPPLIERS, the EQUIPMENT SUPPLIER shall provide for on-site training by an authorized representative of the equipment manufacturer as part of the Supplier’s services. The manufacturer’s representative shall be fully knowledgeable in the operation and maintenance of the equipment.
4. Responsibility for all costs associated with training both on-site and at the EQUIPMENT SUPPLIER’S facilities, including all required materials, texts and required supplies, belongs to CONTRACTOR.
5. All training shall be conducted in the normal eight hour working days until conclusion of the training course.

B. Submittals
1. Submit training plans conforming to the requirements of Section 01821, Instruction of Operations and Maintenance Personnel. Included in the plan shall be course outlines and schedules for training to be provided at the EQUIPMENT SUPPLIER’S facilities.

C. On-Site Training
1. Training Covering the Control Equipment:
   a. The EQUIPMENT SUPPLIERS shall provide 8 hours of operations training covering all system components.
   b. Training course shall accomplish the following:
      1) Provide all instructions required to operate and utilize all system components.
      2) Provide all instruction required to monitor and control the system processes from the designated control panel.
      3) Explain procedures for control of the system during scheduled or rescheduled shutdown and the subsequent start-up.
      4) Provide instructions for routine preventative and troubleshooting maintenance.
2. CCS Training:
   a. The CCS VENDOR shall provide 8 hours of training that covers the CCS as follows:
1) Provide an overview of system hardware and software.
2) It shall train people in configuration, operation and programming the CCS.
3) The emphasis shall be placed on how to perform set point changes, minor programming changes, range changes, diagnostics and upkeep of documentation.
4) Instruction for hardware and software maintenance, troubleshooting and maintenance planning.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials or products which can contact drinking water or a water treatment chemical furnished and installed under this division shall require NSF/ANSI 61, Drinking Water System Components Health Effects, approval or comply with Arizona Administrative Code R18-4-213, Standards for Additives, Materials, and Equipment.

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++
SECTION 17051

PROCESS CONTROL DESCRIPTIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section describes all of the anticipated control strategies under this Contract. The required control strategies for the various unit operations is a combination of the representation shown on the CONTRACT DRAWINGS and the requirements specified herein. The CONTRACT DRAWINGS do not show all the required internal diagnostic indications. In addition to the signals shown on the CONTRACT DRAWINGS, the following process control descriptions shall be provided, as a minimum:

1. Analog Signals:
   a. Analog signals shall be 4 to 20 mADC unless otherwise stated.
   b. Analog signals that are connected to multiple devices in the loop shall be wired in series unless otherwise stated in the loop description.
   c. Loop power for all analog instruments shall be provided in the Local Control Panel (LCP) or Motor Control Panel (MCP). If there is no LCP or MCP, loop power shall be derived from the Computer Control System - Remote Input/Output Panels (RIO)

2. Discrete Signals:
   a. Discrete signals for all field wires shall be designed to be fail safe.
      1) If a field wire for a control circuit device fails the equipment should be designed to shut down.
      2) If a field wire for an alarm circuit fails, the alarm shall be activated.

3. Indication of a communications failure between any of the Programmable Logic Controllers (PLC) with the respective Computer Control System Field Control Unit (FCU) shall be programmed as an alarm in the Computer Control System. The broken communications link must be identified individually to assist in troubleshooting.

4. Indication of a power failure at any of the PLC's and/or FCU panels shall be programmed as an alarm in the Computer Control System and identified individually to assist in troubleshooting.

5. Mismatch alarms for all motorized equipment (e.g., pumps and gates, etc.). If the status feedback does not agree with the command after a time delay, annunciate the alarm in the Computer Control System.

6. Runtimes shall be programmed in the Computer Control System for all pieces of equipment unless elapse Time meters are shown on the P&ID’s or listed in the loop descriptions.
7. Digital and analog signals provided from Vendor supplied equipment that are not shown on the CONTRACT DRAWINGS but are provided by the Vendor shall be verified and incorporated into the control systems.

B. The process control descriptions are written descriptions of the basic configuration and/or programming required to implement the sequential control of the unit processes shown on the CONTRACT DRAWINGS and as specified. The control descriptions do not, in all cases, describe the process characteristics fully. Finalizing and tuning of strategies, as required, by the process characteristics shall be accomplished during start-up.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 Decant Pump Control

A. General:
1. The Decant Pump Station shall be monitored and controlled by the Plant PCS. This will be accomplished by monitoring the wet well, and alarm status of the pump station.

B. Monitoring and Control:
1. Field Instrumentation and Controls:
   a. Wet Well Level
   b. Pump Station Flow
   c. Each pump will have the following:
      1. High Discharge Pressure
      2. Local/Remote Status
      3. Running
      4. Overload fault
      5. Start/Stop Control

2. Motor/Local Control Panel - Controls:
   a. Local Start
   b. Local Stop
   c. Emergency Stop

3. Computer Control System - Controls:
      1. Start
      2. Stop
   b. Computer Auto
      1. Pump Alternation
      2. Start
      3. Stop
4. Equipment Set Points / Ranges

<table>
<thead>
<tr>
<th>Device</th>
<th>Set Point / Range - Typical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Decant Pumps</td>
<td>WS El 962.25 – Low Level Alarm</td>
</tr>
<tr>
<td>All Decant Pumps</td>
<td>WS El 962.50 – All Pumps Off</td>
</tr>
<tr>
<td>Lead “Small” Decant Pump (Pump 5 or 6)</td>
<td>WS El 964.25 – Pump On</td>
</tr>
<tr>
<td>Lag “Small” Decant Pump (Pump 5 or 6)</td>
<td>WS El 965.25 – Pump On</td>
</tr>
<tr>
<td>“Large” Decant Pump (Pump 7)</td>
<td>WS El 966.25 – Pump On</td>
</tr>
<tr>
<td>All Decant Pumps</td>
<td>WS El 966.50 – High Alarm</td>
</tr>
</tbody>
</table>

D. Interlocks:
1. Interlock #1: LIT Low Level Cut off

++ END OF SECTION ++
SECTION 17052

PROCESS CONTROL SYSTEM
PRIMARY SENSORS AND FIELD INSTRUMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment and incidentals as shown, specified and required to furnish, install, calibrate, test, adjust, commission and place into satisfactory operation all primary sensors and field instruments furnished under this Section.
   2. Contract Documents illustrate and specify functional and general construction requirements of the sensors and field instruments and do not necessarily show or specify all components, piping, wiring and accessories required to make a completely integrated system. Provide all components, piping, wiring, accessories and labor required for a complete, workable and integrated system.

B. Coordinate the installation of all items specified herein and required to ensure the complete and proper interfacing of all the components and systems.

1.2 QUALITY ASSURANCE

A. Comply with the requirements of Section 17001, Process Control System General Requirements for Process Instrumentation.

B. Acceptable Manufacturers:
   1. Furnish primary sensors and field instruments by the named manufacturers.
   2. Obtain all sensors and field instruments of a given type from the same manufacturer.

C. Manufacturers' Responsibilities and Services:
   1. Design and manufacture the primary sensors and field instruments in accordance with the applicable general design requirements specified in Section 17001, Process Control System General Requirements for Process Instrumentation, and the detailed Specifications herein.
   2. Field supervision, inspection, and start-up in accordance with the requirements of Section 17001, Process Control System General Requirements.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

91st Avenue WWTP Sludge
Solar Drying Beds 17052-1 05/07/12
A. Comply with the requirements specified in Section 17001, Process Control System General Requirements for Process Instrumentation.

B. Primary sensors and field instruments shall not be delivered to the site until all product information and Shop Drawings for the sensors and instruments have been approved by ENGINEER.

1.4 SUBMITTALS

A. Comply with the requirements specified in Section 17001, Process Control System General Requirements for Process Instrumentation.

1.5 CHEMICAL SERVICE

A. Where a primary element is designated for chemical service, all wetted components and appurtenances for that primary element shall be resistant to corrosion by that chemical. Chemicals referred to commonly as "caustic", "sodium hypochlorite", "hydrochloric acid", "ferric chloride", and "methanol" shall mean the following:

1. "CAUSTIC": Sodium hydroxide (NaOH), 50 percent solution, Specific Gravity = 1.53.
2. "SODIUM HYPOCHLORITE": Sodium Hypochlorite (NaOCl), 15 percent solution, Specific Gravity = 1.23.
3. "HYDROCHLORIC ACID": Hydrochloric Acid (HCl), 38 percent solution, Specific Gravity = 1.4.
4. "FERRIC CHLORIDE": Ferric Chloride (FeCl3), 43 percent solution, Specific Gravity = 1.46.
5. "POLYMER": Polymer Solution, 0.2 to 0.5 percent solution, Specific Gravity = 1.00.
6. "METHANOL": Methanol (CH3OH), 99 percent solution, Specific Gravity = 0.792.

1.6 MATERIALS OF CONSTRUCTION FOR WETTABLE PARTS

A. Provide the following materials of construction for primary sensors and field instrument (wetted) parts that come in contact with the following list of process fluids:
<table>
<thead>
<tr>
<th>PROCESS FLUID</th>
<th>ELASTOMER</th>
<th>METAL</th>
<th>PLASTIC</th>
<th>OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air</td>
<td></td>
<td>Type 316 SS</td>
<td>Teflon</td>
<td></td>
</tr>
<tr>
<td>Alum</td>
<td>Buna-N</td>
<td>Type 316 SS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ammonia</td>
<td></td>
<td>Type 316 SS</td>
<td>Teflon</td>
<td></td>
</tr>
<tr>
<td>Carbon</td>
<td>Buna-N</td>
<td>Type 316 SS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemical Sump Drainage</td>
<td></td>
<td></td>
<td>Teflon</td>
<td>Polypropylene</td>
</tr>
<tr>
<td>Chlorine Gas or Liquid</td>
<td>Viton</td>
<td>Hastelloy C, Monel, or Tantalum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digester Gas</td>
<td>Viton</td>
<td>Alloy C276 Type 316 SS</td>
<td>Polypropylene PVC/CPVC</td>
<td></td>
</tr>
<tr>
<td>Ferric Chloride</td>
<td></td>
<td>Tantalum</td>
<td>Teflon</td>
<td>Polypropylene Ceramic</td>
</tr>
<tr>
<td>Fluoride</td>
<td>Viton</td>
<td>Hastelloy C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glycerine Oil</td>
<td>Neoprene</td>
<td>Type 316 SS</td>
<td>Teflon Polypropylene PVC/CPVC</td>
<td></td>
</tr>
<tr>
<td>Halocarbon</td>
<td>Neoprene</td>
<td>Type 316 SS</td>
<td>Teflon</td>
<td></td>
</tr>
<tr>
<td>Hydrochloric Acid</td>
<td>Viton</td>
<td>Tantalum Zirconium Platinum</td>
<td>Teflon</td>
<td>Ceramic</td>
</tr>
<tr>
<td>Lime</td>
<td></td>
<td>Type 316 SS</td>
<td>Teflon</td>
<td></td>
</tr>
<tr>
<td>Methanol</td>
<td></td>
<td>Type 316 SS</td>
<td>Teflon</td>
<td></td>
</tr>
<tr>
<td>Non Potable Water</td>
<td>Neoprene</td>
<td>Type 316 SS</td>
<td>Teflon</td>
<td>Ceramic</td>
</tr>
</tbody>
</table>
1.7 IDENTIFICATION TAGS

A. All sensors and field instruments shall have an identification tag conforming to the following requirements:
   1. Provide CMMS Tags for all instruments as specified under Section 01630, Computerized Maintenance Management System Tags.

1.8 SUNSHADES

A. Instruments and analyzers installed outdoors shall be firmly supported and protected by sun / rain shades, as specified or shown on DRAWINGS.
   1. Product and Manufacturer: Provide one of the following:
      a. Obrien – VIPAK
      b. Alumaline
      c. Or Equal
PART 2 PRODUCTS

2.1 PROCESS TAPS, SENSING LINES AND ACCESSORIES

A. Water Pressure Sensing Lines and Accessories for Flow and Pressure Transmitters:
1. Material: Type 316 stainless steel; .049 wall thickness.
3. Size: 1/2-inch outside diameter or as shown on the Drawings.
4. Connections: Type 316 stainless steel compression type, "Swagelok", as manufactured by Crawford.
5. Shut-off Valves:
   a. Type: Full port ball.
   b. Pressure Rating: 250 psi.
   c. Body, Ball and Stem: Type 316 stainless steel.
   d. Packing: High Density TFE.
   e. Handle: Nylon with metal travel stops.
   g. End Connections: Removable "Swageloks".
   h. Product and Manufacturer: Provide one of the following:
      1) 45 Series, as manufactured by Whitey.
6. Manifolds:
   a. Type: Five valve and three valve meter manifolds.
   b. Materials: Type 316 stainless steel body, bonnets and stems, delrin seats, Teflon packing.
   c. Product and Manufacturer: Provide one of the following:
      1) Whitey.
      2) Anderson-Greenwood

B. Pressure Tap Sensing Lines and Accessories for Pressure Gages and Pressure Switches:
1. For Process Sensing Taps in Ductile Iron, Steel and Stainless Steel Piping Systems:
   a. Material and Fittings: Type 316 stainless steel pipe (ASTM A 312) and threaded fittings and adapters (ASTM A 403) in accordance with Section 15103, Stainless Steel Pipe.
   b. Sizes: ½-inch minimum for main sensing piping and ¼-inch gage and switch connections or as shown on the Drawings.
   c. Pressure Rating: Equal to or greater than the applicable system test pressure as specified in Section 15050, Piping Systems.
   d. Accessories:
      1) For applications not requiring diaphragm seals, provide separate ¼-inch Type 316 stainless steel threaded gage cocks for each gage and switch.
2) For applications requiring diaphragm seals, provide a separate 1/2-inch threaded Type 316 stainless steel ball valve for seal process side shutoff for each gage and switch. Ball valves shall be provided in accordance with the requirements of Section 15115, Ball Valves, Operators and Appurtenances.

C. For Process Sensing Taps in Copper and Thermoplastic Piping Systems:
   a. Pipe Material and Fittings: Use same type of pipe material and fittings as that used in the process piping system. Copper pipe and fittings shall be provided in accordance with the requirements of Section 15105, Copper Pipe. CPVC pipe and fittings shall be provided in accordance with the requirements of Section 15106, Thermoplastic Pipe.
   b. Sizes: 1/2-inch minimum for main process sensing piping and for gage and switch connections.
   c. Pressure Rating: Equal to or greater than the applicable system test pressure as specified in Section 15050, Piping Systems.
   d. Accessories:
      1) For copper piping system taps with or without seals, provide a separate ¼-inch minimum threaded brass or bronze gage cock for each gage and switch.
      2) For CPVC piping systems with or without diaphragm seals, provide a separate 1/2-inch threaded ball valve for process sensing line shutoff for each gage and switch. Ball valves shall be provided in accordance with the requirements of Section 15113, Thermoplastic Valves, Operators and Appurtenances.

2.2 INSTRUMENTATION

INSTRUMENT TYPE F1 - MAGNETIC FLOWTUBE AND TRANSMITTER

A. Functions:
   1. Flowtube: Produce low level, high impedance pulsed DC signal proportional to the rate of fluid flow using the principle of electromagnetic induction.
   2. Pulsed DC Magnetic Flow Transmitter: Drive the flowtube coils with pulsed DC power and convert the flowtube output signal into a DC current output linear to the flow rate.

B. System (Flowtube and Transmitter) Performance Requirements:
   1. System Accuracy (with Analog Output): ±0.5 percent of flow rate or better over range from 1 fps to 31 fps; ±.005 fps or better at flows below 1 fps flow range. System accuracy shall be proven by submittal of flow
test curves of the actual meters being furnished. Test curves shall show a minimum of three flow points. Tests shall be performed using water and a weight or volume tank. A "Master Meter" used, as a reference standard is not acceptable. The test setup shall be submitted and approved prior to testing.

2. System Repeatability: ±0.15 percent of flow rate or ±.0015 fps, whichever is greater.

3. Drift: Complete zero stability.

4. Minimum Fluid Conductivity Limit: Five microsiemens per centimeter or less.

5. Fluid Property Effects: Accuracy unaffected by changes in fluid velocity, density, pressure, temperature or conductivity (above minimum conductivity limits).

C. Transmitter:

1. Output: 4 to 20 mADC, direct acting and isolated, into 0 to 700 ohms.

2. High accuracy, field adjustable scaled pulse output (2 to 800 Hz or greater) to drive local totalizer and provide scaled pulse output with a durations width of 0.5ms to 2 sec.

3. Power Consumption: Not to exceed 50 watts for flowtube and transmitter combined.

4. Operating Temperature: Suitable for operation with process fluid temperature from 0 to 140°F.

5. Interchangeability: Ratio of flow velocity to voltage reference signals generated identical for all meter sizes to permit interchangeability with transmitter without requiring circuit modifications.


7. Pulse and analog outputs galvanically isolated from input and earth ground.

8. Automatic zeroing feature making it unnecessary to zero the instrument before or after placing it in operation.

9. Precalibrated span adjustment providing continuous span adjustment over entire range. Range adjustment: Integral pushbuttons continuously adjustable for full-scale settings from 1 to 31 feet per second.

10. Signal Conditioning: Adjustable damping circuit with response times of 1 to 25 seconds minimum.

11. Low Flow Cutoff: Provide automatic low flow cutoff circuitry to stop pulse output and local totalization when flow drops below 0.5 percent ±0.2 percent of the calibrated upper range valve.

12. Enclosure:
   b. Finish: Epoxy coating.

13. Mounting:
   a. All transmitter and driver electronics shall be remotely mounted from the flow tubes at locations shown on the Drawings.
b. Provide complete Type 316 stainless steel mounting hardware.

c. Type of mounting (wall, support frame or pipe stand), as required.

14. Local Indication:
   a. 3-1/2 digit minimum LCD meter with field selectable engineering units; or analog multi-meter with linear 0 to 100 percent scale for flow rate indication. The engineering units shall be as specified in the Instrument List.
   b. 7-digit electromechanical totalizer or 8 digit electronic LCD totalizer with reset and lithium battery backup. Count scaling shall be as specified in the Instrument List. Totalizer shall be integral with transmitter and visible through viewing window, or shall be externally mounted in a separate NEMA 4X enclosure or conduit with viewing window and installed adjacent to the transmitter.

15. Power Requirements: Designed for operation on 120 VAC ± ten percent, 60 Hz, ±3 Hz power supply.

16. Accessories:
   a. Protect magnetic flow meter transmitter to flowtube shield cable from the sun and weather.

D. Construction and Required Features:
   1. Flowtube:
      a. Type: Lined metal flowtubes.
      b. Liner Material: PFTE
   2. Tube Material:
      a. Meter tubes 12-inch and smaller: Type 304 stainless steel.
      b. Metering tubes 14-inch and larger: Type 304 stainless steel, .125-inch wall thickness.
   3. Pressure Rating: Greater than or equal to test pressure specified in Section 15050, Piping Systems, for appropriate piping system.
   4. Electrodes:
      a. Conical or elliptical shaped.
   5. Enclosure:
      a. Materials and Rating: Cast low-copper aluminum alloy or fabricated sheet steel, NEMA 6 rated.
      b. Finish: Finish exterior, except for flange faces, with a high build epoxy paint.
      c. End Connections:
   6. Electrical Connections: 1/2 inch minimum to 3/4-inch maximum NPT tapped holes for power conduit fitting and signal conduit fittings.
   7. Type 316 stainless steel grounding rings for flowtubes.
8. Type 316 stainless steel grounding straps.

E. Provide one calibrator suitable to calibrate all flow tubes provided.

F. Product and Manufacturer: Provide one of the following:
   1. Magnetic Flow tube and Signal Converter, as manufactured by Krohne America Incorporated.
   2. Magnetic Flow tube and Signal Converter, as manufactured by ABB/Fischer and Porter.
   3. Magnetic Flow tube and Signal Converter, as manufactured by Endress + Hauser.

INSTRUMENT TYPE F6 - LOCAL INDICATOR (NON-ELECTRICAL)

A. Type:
   1. The local indicator shall be suitable for either pipe stand or wall mounting.
   2. The unit shall receive the differential pressure resulting from the passage of the process fluid and display said differential pressure directly or as a flow.

B. Required Features:
   1. Multiple diaphragm/spring-sensing elements.
   2. Size: 4-1/2 inch.
   3. Dial: White with black marking, 90 degree scale.
   5. Body: NEMA 4X.
   6. Input not to exceed 400-inches water differential pressure.
   7. Process Connections: 1/4-inch FNPT.
   8. Material: All wetted parts to be metal selected from table in Article 1.6, above, based on process fluid being measured.
   9. Accuracy: ±Three percent of full scale.

C. Product and Manufacturer: Provide one of the following:
   1. as manufactured by Mid-West.
   2. Or Equal

INSTRUMENT TYPE PE1 - DIAPHRAGM SEAL

A. General: Furnish diaphragm seals for pressure gages, pressure switches and pressure transmitters at locations shown on the Drawings and as specified.
B. Required Features:
1. Provide fill/bleed screw to permit filling of instrument and diaphragm seal.
2. Instrument Connection: 1/4 inch NPT.
3. Process Connection: 1/2-inch NPT.
4. Working Pressure Rating: Equal to or greater than the attached gage or switch operating pressure specified in Section 15050, Piping Systems, whichever is greater.
5. Filling Fluid:
   a. Silicone.
   b. For Chlorine or Fluoride systems: Halocarbon or Flurolube Oil.
6. Provide a clean-out ring which holds the diaphragm captive in the upper housing to allow the upper housing assembly to be removed for recalibration or cleaning of the process side housing without the loss of filling liquid or change in calibration.
   a. 1/4-inch NPT flushing connection.

C. Construction Features:
1. Top Housing:
   a. Type 316 stainless steel.
   b. For Chlorine gas or liquid: Hastelloy C, Monel, or Tantalum.
2. Material: All wetted parts to be metal selected from table in Article 1.6, above, based on process fluid being measured.

D. Assembly and Calibration:
1. The complete diaphragm seal assembly, including gage, switch or transmitter, shall be factory assembled, filled and calibrated to the ranges and switch setpoints specified prior to shipment.
2. System Supplier shall be responsible for assuring that fill volumes and sensitivities of the supplied seals and diaphragms are suitable to provide the required gage, switch or transmitter accuracy over the specified measurement range or at switch setpoints.
3. Location and orientation of the gages, switches and seal assemblies shall be coordinated with the actual piping and equipment installations so that gages and indicators shall be easily read and accessed for maintenance by plant personnel.
4. Where field mounting and orientation conflicts arise due to incomplete coordination with field changes in the process piping and equipment installation, assemblies shall be relocated, re-oriented, re-assembled and re-calibrated as directed by ENGINEER.

E. Product and Manufacturer: Provide one of the following:
1. as manufactured by Ametek/Mansfield & Green (for low pressures).
2. as manufactured by Emerson/Helicoid.
3. as manufactured by Ashcroft.

**INSTRUMENT TYPE PS1 - PRESSURE SWITCH**

A. Type: Switch assembly with diaphragm piston actuator for sensing gage or differential pressure.

B. Performance Specifications:
   1. Setpoint Accuracy: ± One percent of span.
   2. Adjustable Deadband Range and Setting:
      a. Maximum full scale, minimum seven percent of full scale.
      b. Required Deadband Setting:
   3. Switch: Snap action, SPDT rated not less than five amp resistive at 120 VAC and 1/2 amp resistive at 125 VDC. Provide DPDT contacts and other optional switch configurations when so required.
   4. Switch and Reset (Deadband) Action: Adjustable, Fixed, Manual Reset or Two Stage type.

C. Construction Features:
   1. Material: All wetted parts to be metal selected from table in Article 1.6, above, based on process fluid being measured.
   2. Set and Reset Point Adjustments: Adjustable external adjusting nuts and pressure setting scales.
   3. Process Connection: 1/2-inch NPT.
   4. Housing: Copper-free die cast aluminum, NEMA 4; NEMA 7 construction required for hazardous areas.
   5. External Mounting Lugs.
   6. Adjusting Nuts Metal Cover with Gasket on NEMA 4 and NEMA 7 rated units.
   7. Electrical Connection: 3/4-inch NPT.

D. Assembly: Where specified equipment is shown to be mounted to annular or diaphragm seals, equipment and seal shall be factory assembled, calibrated and furnished as a single unit.

E. Product Manufacturer: Provide pressure switch of one of the following:
   1. Ashcroft,
   2. United Electric Controls,
   3. Barksdale,
   4. Dwyer

++ END OF SECTION ++
SECTION 17260
CONTROL PANELS

PART 1 GENERAL

1.1 SCOPE

A. Contract Documents illustrate and specify functional and general construction requirements of the panel components and do not necessarily show or specify all components, wiring, and accessories required for a completely integrated system.

B. Provide all labor, materials, equipment, documentation including drawings and incidentals as shown on the Drawings, specified and required to design, furnish, install, calibrate, test, start-up, program, configure, commission and place into satisfactory operation all panels, intermediate termination panels and/or enclosures including panel components and instruments.

C. Conform the design and construction of panels to the specifications herein.

1.2 COORDINATION

A. Coordinate the installation of all items specified herein and required to ensure the complete and proper interfacing of all the components and systems.

B. All control loops to function as described in Section 17051, Computer Control System Process Control Descriptions and depicted on the CONTRACT DRAWINGS.

1.3 DEFINITIONS

A. Intermediate Termination Panel (ITP): An Intermediate Termination Panel is any junction box that has terminals to terminate wires and no electrical or electronic powered devices. These panels act as interim termination points for field wiring to be connected to the control systems equipment. Please note that junction boxes and pull boxes are different. ITP’s are sometimes referred to as junction boxes. However, pull boxes are not allowed to have any wire splicing devices, including terminal blocks.

B. Local Control Panel (LCP): A Local Control Panel is an industrial piece of equipment that contains electrical or electronic devices, in addition to wire terminals. Typically, it is a local panel connected to a specific piece of equipment to provide control and/or monitoring of that equipment. A local control panel contains voltages of 120VAC or below.
C. **Motor Control Panel (MCP):** An Motor Control Panel is an industrial piece of equipment that houses components for the power distribution and starting of motors. The components may include motor starters and variable frequency drives.

### QUALITY ASSURANCE

A. Reference Standards: Construction of panels and the installation and interconnection of all equipment and devices mounted within also comply with applicable provisions of the following, except where otherwise shown or specified.

1. National Fire Protection Association 79
3. National Electrical Manufacturer's Association Standards (NEMA)
5. Operational Safety and Health Administration (OSHA) Regulations
6. State and local code requirements
7. Where any conflict arises between codes or standards, the more stringent requirement applies.
8. All panel devices shall bear the label of the Underwriters’ Laboratory (UL), Inc. or be UL Recognized. Some products certified by UL are components that are intended to be used in the manufacture of a complete listed product. These components cannot bear the UL symbol, but may use a special Recognized Component Mark.
   a. The UL/UR listed number shall be documented on the Bill of Materials on the drawings.
9. The assembled LCP’s and MCP’s are to be conformed to meet UL 508 requirements and labeling.

B. Panel to be designed, schematics drawn and assembled by the manufacturer. Utilize one of the following Panel Manufacturers:

1. RDC Electric
2. Industrial Power Solutions

### SUBMITTALS

A. General:

1. Reference Section 01330 Submittals.
2. Panels shall be furnished in accordance with the requirements as shown on the Drawings, and as specified in Division 16, Section 16050 and Division 17000, Sections 17001, 17051, 17052, 17053, 17226 and 17260.
4. Submit legible hard copies of the panel drawing package printed on 11” x 17” sheets.
5. Submit manufacturer’s technical data sheets and product literature for the panel.
and all components utilized. Clearly identify exact equipment and material that is being supplied on the manufacturer’s data sheets.

6. Submit a sample nameplate with the submittal.

7. Identify general location of all conduit entry points on the Front Elevation drawing of the documentation package.

8. Submit calculations and recommended cooling and heating load requirements. Utilize the Hoffman Temperature Calculation tool at:

9. Submit location and tube routing details for air conditioner drain line. Coordinate drain location with ENGINEER.

1.6 O&M Manuals

   A. Comply with the requirements of Section 01781, Operations and Maintenance Data.

   B. Provide an electronic copy of the panel drawing package on a separate CD. Panel Drawings are to be provided electronically in AutoCAD version 2004 through 2008. If utilizing a newer AutoCAD version, submit files saved at version 2008.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

   A. Comply with the requirements of Section 01651, Transportation and Handling of Materials and Equipment.

   B. Comply with the requirements of 01661, Storage of Materials and Equipment.

   C. Provide a hard copy of the panel drawings, size 11” x 17”, inside the panel upon delivery.

PART 2 - PRODUCTS

2.1 PANEL ENCLOSURES

   A. General:
      1. Conform panels and enclosures to the NEMA requirements as stated in Specification 16050 – General Requirements.
      2. All outdoor panels shall be provided with sunshade structures. Sunshade structures shall be constructed as shown on CONTRACT DRAWINGS.
      3. Sizes shown on contract drawings are estimates. Furnish panels and enclosures sized to house all equipment, instruments, front panel mounted devices, power supplies, power distribution panels, wiring and other components installed within.
      4. Size the panel to provide 20% spare free space capacity.
      5. Use stainless steel fasteners throughout.
      6. Provide interior mounting panels and shelves constructed of minimum 12 gage steel.
      7. Provide 12”x12’ print pocket in panels with a 24” or larger door. Mount on
inside door where no door mounted devices are located. If there is not enough room for a 12”x12” print pocket, provide a sized pocket to fit available room.

8. Provide enclosure mounting supports as required for floor, frame, or wall mounting. Indoor wall mount panels utilizing stainless steel unistrut. Outdoor wall mount panels utilizing pcv coated unistrut.

B. Construction Features:
   1. General Construction Features - Provide the following convenience accessories inside of each panel.
      a. One or more 120 VAC light fixtures with a minimum 40 watt lamp or LEDs with a snap switch for on/off control.
      b. Provide grounding studs or lugs for metal panels and doors.
      c. Provide all electrical components and devices, support hardware, fasteners, and interconnecting wiring required to make the panels and/or enclosures complete and operational.
      d. Provide oil resistant gasket completely around each door or opening.
      e. For panels located in the field or outdoors that have door mounted devices which do not meet the NEMA rating for the area, provide a window kit that includes a hinged door with a clear plastic window and an oil resistant gasket to encompass all non-NEMA rated panel instruments for this area.
      f. Provide full height doors.
      g. Provide panels with no extra holes or knockouts unless shown on CONTRACT DRAWINGS.

C. Environment
   1. General:
      a. Provide the following panel(s) with an air conditioner, heat exchanger or ventilation fan based on the submitted calculations for cooling and/or heating load requirements.
         1) N/A
      b. Provide a heater for all panels located outdoors to maintain a minimum temperature of 68°F.
      c. Provide a separate supplementary protector for the cooling or heating equipment.
      d. Provide thermostats to automatically control heating and cooling requirements.
      e. Provide a high temperature switch, for alarm purposes, in all panels that require air conditioners, heat exchangers or ventilation fans. The contact shall be wired to alarm to the Computer Control System.
         1) Products and Manufacturers:
            a) Hoffman ATEMNC
            b) Or Equal
      2. Air Conditioner:
         a. Coordinate utilization of air conditioners with the ENGINEER.
         b. Provide an automatically controlled closed loop air conditioner with filtered and adjustable air louvers to maintain temperature inside each enclosure below the maximum operating temperature rating of the lowest rated component.
         c. Provide a condensation drain line for each air conditioner.
d. Coordinate space requirements for maintenance.

e. Provide NEMA 4X for outdoor locations.

f. Coat heating and cooling elements including external housing that are in contact with Plant’s ambient environment with Heresite, or equal, for protection from hydrogen sulfide corrosion with hydrogen sulfide levels up to seven ppm.

   1) Coordinate application of coating with the ENGINEER.

g. Product and Manufacturer:
   1) Hoffman (McClean)

3. Heat Exchanger:
   a. Coordinate utilization of heat exchangers with the ENGINEER.

   b. Provide an automatically controlled heat exchanger to maintain temperature inside each enclosure below the maximum operating temperature rating of the lowest rated component.

   c. Coordinate space requirements for maintenance.

   d. Products and Manufacturers:

       1) Hoffman

4. Ventilation Fan:
   a. Coordinate utilization of ventilation fans with the ENGINEER.

   b. Provide automatically controlled ventilation fans with filter to maintain temperature of indoor enclosures below the maximum operating temperature of the lowest rated component.

   c. Products and Manufacturers:

       1) Hoffman

       2) Or Equal

5. Heater:
   a. Provide adequately sized automatically controlled 120 VAC heaters to maintain temperature inside each enclosure above 40°F to a maximum of 80°F when the outside temperature is 0°F through 40°F.

   b. Maintain a minimum four inch clearance or minimum clearance recommendations from the manufacturers from any device.

   c. Product and Manufacturer:

       1) Hoffman

       2) Or Equal

D. Identification:

   1. Provide laminated plastic nameplates with a white background and black lettering for identification of panels and components.

   2. Construct nameplates with 1/16” plastic and with beveled edges.

   3. Nameplate Mounting

      a. Indoor panels: Mount nameplates to the panel utilizing glue.

      b. Outdoor panels: Mount nameplates to the panel utilizing glue and with two self-sealing ¼” stainless steel screws by APM Hexseal.

      c. Glue Product and Manufacturer

          1) Gorilla Glue

          2) Or Equal
4. Provide nameplates according to Table 2.1.C.5 and Section 3.1.B:

<table>
<thead>
<tr>
<th>Type</th>
<th>Size</th>
<th>Font</th>
<th>Font Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturer Nameplate</td>
<td>*1½” x 6”</td>
<td>Arial</td>
<td>1/8”</td>
</tr>
<tr>
<td>Panel Nameplate</td>
<td>*2” x 7”</td>
<td>Arial</td>
<td>1/2”</td>
</tr>
<tr>
<td>Device Nameplate</td>
<td>*1½”x 2½”</td>
<td>Arial</td>
<td>3/16”</td>
</tr>
</tbody>
</table>

Table 2.1.C.5 Nameplate Specifications

* This is a minimum height size requirement. Size nameplates large enough to display the information required to clearly identify the panel.

2.2 PANEL DEVICES:

A. General:
   1. Provide DIN rail mounted devices where practical.
   2. All devices mounted on the exterior of the panel shall match the NEMA rating of the panel.

B. Internal Component Labeling:
   1. Provide a device label for devices mounted inside the panel that conforms to the criteria below:
      a. Instruments: Provide label with the instrument loop number as shown on the CONTRACT DRAWINGS. Place label below the instrument on the backplane.
      b. Supplementary Protector: Label each supplementary protector with CB and the number assigned in the supplementary protector schedule. Place label on the backplane.
      c. Fuses: Label each fuse with FU and the number assigned in the fuse schedule. Place label on the backplane.
      d. Control Relays: Label each relay with CR and the number assigned in the panel drawings. Place label below the relay on the backplane.
      e. Terminal Strips: Label each terminal strip with the terminal strip type. (ex. TB1, TB2, ATB). Place label above the terminal block or at first terminal on the backplane.
      f. Door Mounted Devices: Provide a label on the interior of the front panel door for every panel device. The label should contain the same information as shown on the front panel nameplate. Place the label below the device.
      g. Wireway Covers: Label wireways with the voltage that is being routed through it. For example; “24 VDC” for DC voltage or “120VAC” for AC
电压。将标签放在电线槽盖上。协调标签尺寸以适应电线槽盖。

h. 识别内部组件，使用永久性粘性塑料标签。

1) 产品和制造商:
   a) Brady USA Inc.
   b) Or Equal

2) 提供设备标签尺寸和字体，请参见表2.2B.1:

<table>
<thead>
<tr>
<th>Device</th>
<th>Label Size</th>
<th>Font Size</th>
<th># Points</th>
<th>Brady Part #</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Wireways) 24VDC</td>
<td>1”x 4”</td>
<td>Arial</td>
<td>48 Points</td>
<td>PTL-42-422</td>
</tr>
<tr>
<td>(Wireways) 120VAC</td>
<td>1”x 4”</td>
<td>Arial</td>
<td>48 Points</td>
<td>PTL-42-422</td>
</tr>
<tr>
<td>Misc. Device Labels</td>
<td>1”x 1”</td>
<td>Arial</td>
<td>16 Points</td>
<td>PTL-19-423</td>
</tr>
<tr>
<td>Panel Door Devices</td>
<td>1” x 1.5”</td>
<td>Arial</td>
<td>8 Points</td>
<td>PTL-31-423</td>
</tr>
</tbody>
</table>

### Table 2.2.B.1 Panel Interior Device Label

C. DIN Rail
   1. 一般：DIN导轨是用于在面板上安装各种电气组件的金属导轨。
   2. 将所有内部组件安装在DIN导轨上。
   3. DIN导轨用于终端块时，应使用与电线槽相同的高度。
   4. 产品和制造商，提供以下模型，其中“xx”是适当的额定值。
      a) Phoenix Contact, TMC 1-M1-xxA
      b) Allen-Bradley, 1492-SP1Bxxx
      c) Idec, NRC-11-0-L-xxA-AA

D. 控制电路—补充保护器：
   1. 提供单极补充电路保护器，具有以下特性，120伏交流，DIN导轨安装，并UL 1099列表带有辅助触点。
   2. 提供端帽、标记条、绝缘侧跳线和其他附件。
   3. 产品和制造商，提供以下模型，其中“xx”是适当的额定值。
      a) Phoenix Contact, TMC 1-M1-xxA
      b) Allen-Bradley, 1492-SP1Bxxx
      c) Idec, NRC-11-0-L-xxA-AA

E. 空调或加热补充保护器：
   1. 提供补充保护器，具有以下特性，120伏交流，DIN导轨安装，并UL 489列表带有辅助触点。
   2. 产品和制造商，提供以下模型。
      a) Allen-Bradley, Bulletin 1489
      b) Or Equal
F. Control Relays:
   1. Type: General purpose, plug-in type rated for continuous duty.
   2. Construction Features:
      a. Coil Voltages: 120 VAC
      b. Contacts:
         1) Silver cadmium oxide rated not less than ten amperes resistive at 120
            VAC or 28 VDC continuous.
         2) For switching low energy circuits (less than 200 ma) fine silver, gold
            flashed contacts rated not less than three amperes resistive at 120 VAC or
            28 VDC continuous shall be provided.
         3) Number of contacts:
            a) Minimum: Two double pole/double throw contact sets
            b) Maximum: Four double pole/double throw contact sets.
      c. Relays shall have a clear plastic dust cover.
      d. Socket type to be blade.
      e. Relays shall not have an LED indicator
   3. Product and Manufacturer: Provide one of the following:
      a. Type R and/or Type K, as manufactured by Square D Company.
      b. Type RH and/or Type RY, as manufactured by IDEC.
      c. Potter & Brumfield.

G. Time Delay Relay:
   1. Type: Dial adjustable, plug-in type time delay relay providing delay-on-make,
      delay-on-break one shots or interval operation.
   2. Construction Features:
      a. MOS digital circuit with transformer coupled power.
      b. Switch selectable ranges
      c. Minimum Setting: Three percent of range; except 50 ms for one second
         range.
      d. Contacts:
         1) Type: DPDT.
         2) Rating: Seven amps resistive at 120 VAC, seven amps at 24 VDC.
      e. Housing:
         1) Plug-in design with dust and moisture resistant molded plastic case.
      f. Power Input: 120 VAC
   3. Product and Manufacturer: Provide one of the following:
      a. as manufactured by Automatic Timing and Controls Company.
      b. as manufactured by IDEC.

H. Selector Switches, Pushbuttons and Indicating Lights:
   1. General:
      a. Selector switches, pushbuttons and indicating lights shall be supplied by one
         manufacturer and be of the same series or model type.
      b. Type: Heavy duty, oil tight
c. Mounting: Flush mounted on panel front, unless otherwise noted.
d. NEMA rated to match panel in which mounted.

2. Selector Switches:
a. Type: Provide selector switches with number of positions as required to
perform intended functions as shown on the Drawings and specified.
b. Contacts:
   1) Provide number and arrangement of contacts as required to perform
      intended functions specified, but not less than one single pole, double
      throw contact.
   2) Type: Double break, silver contacts with movable contact blade
      providing scrubbing action.
   3) Rating: Compatible with AC or DC current with devices simultaneously
      operated by the switch contacts, but not less than ten amperes resistive at
      120 volts AC or DC continuous.

c. Switch Operator: Standard black knob.

3. Pushbuttons (Standard or Illuminated):
a. Momentary Type: Provide momentary, booted type pushbuttons as required
   to perform intended functions specified and shown on the Drawings. Boot
   color to be red for stop buttons and black for other functions.
b. Maintained Type: Provide maintained, push/pull, “Mushroom” type, red in
   color, to perform intended functions as specified, and as shown on the
   drawings.
c. Contacts: Comply with the requirements specified for selector switches.

4. Indicating Lights:
a. Type: Compact, integral non-transformer type.
b. Lamps: 120 VAC, long life (20,000 hours minimum).
c. Common, push-to-test circuitry shall be provided for each panel to simulta-
   neously test all indicating lights on the panel using a single pushbutton.
d. Button and Lens Colors:
   1) Red for indication of open, on, or running.
   2) Green for indication of closed, off (ready), or stopped.
   3) Amber for indication of equipment malfunction, process trouble or
      alarms.
   4) White for indication of electrical control power on.

5. Rotary Cam Switches:
a. Provide rotary cam switches with number of positions and poles as required
   performing the signal switching function specified and shown on the
   Drawings.
b. Contacts:
   1) Gold-flashed contacts housed in mechanical contact blocks with number
      and arrangement of contacts as required performing intended function.
   2) Contact Rating: Compatible with AC or DC through-put current of
      signals and devices simultaneously operated by the switch contacts, but
      not less than 20 amperes at 600 VAC or 250 VDC continuous.

c. Switch Operator: Standard black knob.

6. Product and Manufacturer: Provide one of the following:
I. Potentiometer:
1. Type: Industrial potentiometer operator, direct acting, 3/4 to full turn; and standard 3-wire potentiometer.
2. Required Features:
   a. NEMA rated to match panel in which mounted.
   b. Resistance Range: 0 to 10,000 Ohms.
   c. Resistance Element: Wire wound or conductive plastic.
   d. Power Rating: Two watts.
   e. Mounting: Flush mounted on panel front, unless otherwise noted.
   f. Provide legend plate for indication of position (0 to 100 percent).
3. Product and Manufacturer: Provide one of the following:
   a. Square D.
   b. General Electric.
   c. Allen-Bradley Co.

J. Power Supply:
1. General
   a. Panel power supply source, type, voltage, number of circuits and circuit ratings shall be as shown on the Contract Drawings.
   b. Panels shall be provided with an internal 120 VAC with number of circuits and separate supplementary protectors sized as required to distribute power to the panel components.
2. 24VDC Power Supplies:
   a. General:
      1) Single unit and multiple unit power supplies, located in control room panels, intermediate termination panels and field panels, as required.
      2) Single Unit Required Features:
         a) Solid state circuitry
         b) Surface mounting
         c) Input Power: 120 VAC, ± 10 percent, 60 Hz.
         d) Output Power: 24 VDC or as required.
         e) Line/Load Regulation: 0.05 percent.
         f) Ripple: 0.25 mv RMS.
         g) Overload Protection: Internal preset or fused.
   3. Product and Manufacturer: Provide one of the following:
      a. Acopian Corporation.
      b. Power One.
      c. Lambda.
      d. Sola.
   4. If redundant power supplies are required: Provide one of the following:
      a. Lambda DPL-PU/E
K. Wire:
1. General
   a. Provide internal wiring of Type MTW stranded copper wire with thermoplastic insulation with no nylon jacket rated for 600 V at 90°C for single conductors.
   b. No utilization of Type THHN for panel wiring.
   c. For DC panel signal wiring, use #16 AWG shielded minimum.
   d. For AC power wiring, use #14 AWG minimum. For AC signal and control wiring, use #16 AWG minimum. For wiring carrying more than 15 amps, use sizes required by NEC and NFPA 79 Standards.
   e. Identify wires at each end using heat shrink labels with permanent number codes using a Brady LS2000 Labeling System, or equal.
   f. Panels conform to the wire color code as shown in Table 2.2.K.1.f Wire Color Code.
2. Product and Manufacturer: Provide one of the following:
   a. Carol
   b. Belden
   c. Anixter

<table>
<thead>
<tr>
<th>WIRE COLOR CODE TABLE (Inside Panels)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TYPE</td>
</tr>
<tr>
<td>AC POWER - HOT</td>
</tr>
<tr>
<td>AC POWER - NEUTRAL</td>
</tr>
<tr>
<td>AC GROUND</td>
</tr>
<tr>
<td>AC CONTROL</td>
</tr>
<tr>
<td>ISOLATED DC GROUND</td>
</tr>
<tr>
<td>DC POWER</td>
</tr>
<tr>
<td>DC POWER</td>
</tr>
<tr>
<td>CONTROL</td>
</tr>
<tr>
<td>LOW VOLTAGE AC</td>
</tr>
<tr>
<td>LOW VOLTAGE AC</td>
</tr>
<tr>
<td>*AC POWER</td>
</tr>
</tbody>
</table>
Table 2.2.K.1.f Wire Color Code

* - For Motor Control Panels (MCP’s) that are permitted to contain 480 VAC

** - Black 120 VAC wires are hot unless powered down via supplementary circuit protector. Red 120 VAC wires are hot based on the control logic state.

L. Single Shielded Pair Cable:
1. Tinned copper, nineteen strand, PVC insulated conductors, No. 16 AWG minimum, twisted with aluminum-polyester shield, stranded tinned 16 AWG copper drain wire and PVC black or gray outer jacket. Wire conductor colors shall be black (-neg) and red (+pos). 600 Volt Tray Cable (TC) rated.
2. Product and Manufacturer: Provide one of the following:
   a. Belden Company (No. 9342).
   b. Okonite Company.
   c. Dekoron Wire and Cable Company.

M. Wire Terminations:
1. Terminate all field and internal component wiring using insulated ferruled connectors attached with manufacturer’s recommended tool.
2. Excessive stripping of the wire so as to allow bare wire outside the insulated ferrule is not permitted.
3. Utilize insulated double ferruled connectors wherever two wires terminate on the same terminal block connection.
4. Product and Manufacturer: Provide one of the following:
   a. Phoenix Contact – Clipline
   b. Thomas & Betts
   c. Weidmuller

N. Terminal Blocks:
1. General
   a. Numerically code terminals utilizing terminal block manufacturer’s marking system. Information must be printed directly on the terminal label. Sticky back labels are not permitted.
   b. Terminal blocks must be DIN rail mountable with screw clamp connections. Spring cage connections are not permitted.
   c. Double level terminal blocks are permitted for use with signals on ATB only.
   d. Terminals used for analog signals on ATB shall be colored blue.
e. Terminal block jumpers must be connected via screw clamp. Screw clamped comb jumpers are permitted. Plug in jumpers are not permitted.

2. Product and Manufacturer: For each terminal strip type provide one of the following:
   a. Power Terminal Block (PTB)
      1) Phoenix Contact, Type UK 5 N, Color Gray, Model # 30 04 36 2
      2) Allen Bradley, Type 1492-J4, Color Gray, Model # 1492-J4
      3) Weidmuller, Type WSU 4, Color Dark Beige, Model # 102010000
   b. Field Wiring Discrete Signal Terminal Blocks (TB1 and TB2)
      1) Phoenix Contact, Type UDK 3, Double Connection, Color Gray, Model # 27 75 37 5
      2) Weidmuller, Type WDK 2.5V, Double Connection, Double Level, Internal Connection, Color Dark Beige, Model # 102230000
   c. Field Wiring Analog or Internal Wiring DC Power (ATB) - Single Level Terminal Blocks (DC):
      1) Phoenix Contact, Type UK 3N BU, Color Blue, Model # 30 01 51 4
      2) Allen Bradley, Type 1492-J3-B, Color Blue, Model # 1492-J3-B
      3) Weidmuller, Type WDU 2.5 BL, Color Blue, Model # 102008000
   d. Field Wiring Analog or Internal Wiring DC Power (ATB) - Double Level Terminal Blocks. Alternating double and single level ATB terminal blocks are permitted.
      1) Phoenix Contact, Type MBKKB 2,5 BU, Double Level, Color Blue, Model # 27 71 09 4
      2) Allen Bradley, Type 1492-JD3-B, Double Level, Color Blue, Model # 1492-JD3-B
      3) Weidmuller, Type WDK 2.5 BL, Double Level, Color Blue, Model # 102158000

O. Surge Protection:
   1. Provide DC surge protection with integrated varistor for all analog signal loops that are terminated to Programmable Logic Controllers provided in accordance with Specification Section 17262 – Programmable Logic Controller, Software and Programming.
   2. Provide maintenance free, self-restoring surge protection to protect the electronic instrumentation system from surges propagating along the signal and power supply lines. Device shall be removable without interrupting the circuit
   3. Provide a separate surge protector for the positive and a separate surge protector for the negative polarity of each loop.
   4. Mount the surge protectors on the ATB.
   5. Ground the surge protectors to the panel DC ground bus.
   6. Label the surge protectors in sequential order starting with the ATB signals.
   7. Required Features:
      a. Amp Rating: Compatible with working voltage and current of device being protected.
      b. Voltage Rating: Compatible with the working voltage of protected device.
c. Reaction Time: nanosecond range

8. Product and Manufacturer: Provide one of the following:
   a. Phoenix Contact
   b. Advanced protection Technologies
   c. EDCO
   d. Or Equal

P. Wireways:
   1. General:
      a. Mount wireways using stainless steel bolts. Drill and tap the sub-panel to accommodate the bolts.
      b. Color to be Gray or White throughout the entire panel. Provide only one color.
      c. All wireways to include cover.
      d. Wireway covers to be labeled as per section 2.2.B
   2. Product and Manufacturer: Provide one of the following:
      a. Panduit
      b. Thomas & Betts
      c. Or Equal

Q. Motor Starters and Overload Relays:
   1. Refer to Specification Section 16423 – Motor Control Centers or 16422 – Combination Motor Starters

PART 3 - EXECUTION:

3.1 EXTERIOR PANEL:

A. Component Layout:
   1. Arrange associated control and indication devices for a particular part of the process in close proximity to each other.
   2. Mount indicating lights above control switches and push buttons.
   3. Standard component spacing is 3 ½” center to center and 3 ½” above and below. It is acceptable to use more space if required, but spatial consistency must be maintained.
   4. Maximum height for panel exterior-mounted devices is 6’-0” from the floor. Minimum height for panel exterior-mounted devices is 3’-0” from the floor.
   5. Locate alarm horn at the top of the panel. The alarm horn may be located above 6’-0” device height limitation.
   6. Unless otherwise noted; route field wiring through the bottom of the enclosure. Provide watertight conduit openings.

B. Exterior Panel Nameplates
   1. General
a. Refer to Section 2.1.D for material and size requirements.

b. Provide specific panel identification on nameplates derived from the CONTRACT SPECIFICATIONS and DRAWINGS.

c. Obtain ENGINEER approval for panel identification for panels that are not identified in the CONTRACT SPECIFICATIONS and DRAWINGS.

2. Panel Manufacturer Identifier and Power Requirements Nameplate (NP-1)

   a. Mount nameplate in the upper left corner of the panel front.

   b. Provide the following information for each circuit feeding the panel.

      1) The first line indicates the name of the manufacturer, location and phone number of who assembled the panel.

      2) The following lines:

         a) Include panel voltage, current, phase, frequency, short circuit current rating for each panel feed.

         b) Provide switchboard name and circuit number for each circuit feeding the panel.

         c) Refer to figure 3.1.B.2

MITCHELL & Sons, TOLLESON, AZ - (602) 555-1212
120 VAC, 0.5 AMPS, 1Ø, 60HZ, SCCR 5KA, FED FROM LP-34, CIRCUIT 6
120 VAC, 7.5 AMPS, 1Ø, 60HZ, SCCR 8KA, FED FROM LP-34, CIRCUIT 8

Figure 3.1.B.2
Panel Manufacturer Identifier and Power Requirements Nameplate (NP-1)

3. Panel Identification Nameplate (NP-2)

   a. Mount panel identification nameplate in the top, center of the panel.

   b. Provide the following information:

      1) The first line of text is an abbreviation of the panel as shown on the CONTRACT DRAWINGS.

      2) The second line of text on the nameplate is used to spell out the process abbreviation.

      3) Refer to figure 3.1.B.3.
4. Panel Component Nameplates
   a. Mount nameplates above all control and indicating devices.
   b. Provide the following information:
      1) The first line indicates the instrument device loop identifier and number as shown on the DRAWINGS.
      2) The second line identifies the system equipment that the component is associated with.
      3) The third line identifies the control position, condition of the equipment or the alarm state being monitored.
      4) Refer to figure 3.1.B.4

3.2 INTERIOR PANEL
   A. General:
1. All Wall Mounted Panels - Where conduit enters the panel, maintain a minimum of 4” clearance from any device or wireway to allow room for routing of field wiring.

2. Concrete Pad or Floor Mounted LCP’s and MCP’s – Where conduits enter the panel through the concrete pad, maintain a minimum of 6” clearance from any device or wireway to allow room for routing of field wiring. Where conduit enters the panel sides or top, maintain a minimum of 4” clearance from any device or wireway to allow room for routing of field wiring.

3. Elevated Floor Mounted LCP’s and MCP’s - Where conduit enters the panel, maintain a minimum of 4” clearance from any device or wireway to allow room for routing of field wiring.

4. Concrete Pad, Floor Mounted or Elevated Floor Mounted ITP’s - Where conduits enter the panel, maintain a minimum of 6” clearance from any device or wireway to allow room for routing of field wiring.

5. Locate and install all devices and components so that connections can be easily made and that there is ample room for servicing each item.

6. Maintain a minimum 2’0” clearance between components mounted on side panels and components mounted on the opposing side panel.

7. Components mounted on the back panel are to be unobstructed by any components mounted on side panels.

8. Adequately support and restrain all devices and components mounted on or within the panel to prevent any movement.

B. Panel Incoming Power:

1. Panel power fed from lighting panels, or other sources with fused or circuit breaker protection, shall be wired to the Power Terminal Blocks (PTBs). Power sources entering the panel are to be provided with a separate neutral and ground. The PTBs shall have a separate terminal for the hot and neutral for each circuit. The ground to be terminated to the AC ground bar.

2. Mount the PTBs near the top left corner of the panel.

3. Multiple power sources may be required for each panel. Power requirements are identified on the CONTRACT DRAWINGS. The following additional power sources may be required for the panel.
   a. Control Logic Power and Light Fixture
   b. Air Conditioning

4. Arrange the terminal strip in an orderly manner with circuit conductors grouped together. For instance, terminate the hot and neutral conductors on consecutive terminals. Label terminals and internal wiring as H1 and N1 (Control Logic), H2 and N2 (Air Conditioning). Identify each additional source in sequential order beginning with H3 and N3.

5. Terminate all incoming power on one side of the terminal strip.

C. AC Power Distribution:

1. Identify the wire extending from the PTB to the supplementary protector as H1 and H2, etc. Using H1 as an example; the wire terminated to the line side of the
supplementary protector is labeled H1, the wire terminated to the load side of the supplementary protector is labeled as L1-1.

2. If L1-1 passes through an additional supplementary protector to feed panel components, this supplementary protector can be shown on the drawings in a horizontal or vertical position on a schematic rung and the wire terminated to the line side of the supplementary protector is labeled L1-1. The wire terminated to the load side of the supplementary protector is labeled L1 – (the Supplementary Protector #) and the wire color is black.

3. If the panel controls multiple pieces of equipment, such as two pumps with separate control circuits, provide a supplementary protector for each control circuit.

4. Powering 120 VAC field 4-wire instruments from the panel is not permitted.

D. DC Power Distribution:
   1. Mount DC power supplies near the top right of the panel. Mount fuses associated with the power supply in close proximity to the power supplies.
   2. Identify terminals used for DC power distribution as PTB-DC.
   3. Provide a fuse for each analog loop that loop power is provided by a power supply located in the panel.

E. Grounding:
   1. AC Ground:
      a. Provide the AC ground bus bar with cage type or screw terminals installed near the bottom of the back panel with extended mounting bolts.
      b. Provide adequate metal to metal contact between the AC ground bus bar and the back plane.
      c. Connect all AC power sources and devices to ground at this ground bus.
      d. Connect all panel enclosure doors to the AC ground bus.
      e. Connect all side panels to the AC ground bus.
      f. Provide a connection point on the ground bus for connection to the ground grid system.
   2. DC Ground:
      a. Install the isolated DC grounding bus bar with cage type or screw terminals installed near the bottom of the back panel at a minimum distance of 6” from the AC ground bus.
      b. The isolated grounding bus bar consists of two non-conductive mounting blocks with a single copper grounding bar attached between them.
      c. Connect all shields (SH) requiring loop grounding in the panel from the analog signal terminals to the DC grounding bus bar.
      d. To avoid ground loops, connect analog cable signal shields to ground at one location only, preferably in the LCP, MCP or ITP; not in the field. Maintain consistency for the termination point of signal shield for all analog signals.
      e. Provide a connection point on the ground bus for connection to the ground grid system.
f. Figure 3.2 illustrates a typical ground system within a panel. The illustration depicts the physical terminations of the ground wires in the panel. Ground Conductor AWG size to ground grid system shall be as stated in Specification 16061 – Grounding Systems.

![Grounding System Diagram](image)

**Figure 3.2**

**Typical Grounding Systems**

F. Circuit Protection:
1. Provide an isolating supplementary protector for each group of control logic. For example: the start, stop and reset control circuit for Pump #1 has a dedicated supplementary protector supplying power to the control logic. Pump #2 requires a separate isolating supplementary protector for the control logic.
2. Provide an isolating supplementary protector for each component requiring 120 VAC power.
3. A supplementary protector is not required for control circuits powered from a fused control power transformer in an MCP.
4. Size supplementary protector to handle the connected load.
5. Mount supplementary protector next to the PTBs near the top left corner of the panel.
6. Provide an auxiliary contact for each supplementary protector. Wire each auxiliary contact from the supplementary protector in series to one “Power fail” relay. Send one Power Fail status to the Computer Control System.

G. Internal Panel Wiring:

1. Route all internal wiring using wireways. Terminate all internal wires on one side of the terminal blocks. The opposite side of the terminal block shall remain available for field wires.
2. Where wires pass through panel walls, provide suitable bushings to prevent cutting or abrading of insulation.
3. Adequately support and restrain all wiring runs to prevent sagging or other movement. Wires extended from the control logic to the panel door devices are to be wrapped in plastic protective wire wrap designed for this purpose.
4. Wire splicing is not allowed at any time.
5. Utilize two wires (hot and return leg) with field wiring for each field input. It is not acceptable to utilize one common Hot for multiple field inputs.
6. Terminate wires with a non-insulated ferrule type crimp connector. Excessive stripping of the insulation to allow bare wire strands between the insulation and the ferrule is not permitted.
7. Orientate wire labels on the individual conductor or cable so that wire labels are legible without having to twist or move the connectors. Securely heat shrink the labels around the conductor. Label wires or cables with the number assigned in the panel documentation. Refer to Section 2.2.K.1.e for wire label materials.
8. DC wiring for analog and discrete field or Computer Control System signals that enter or leave the panel are to be terminated on the Analog Terminal Block (ATB).
9. AC wiring for discrete field signals that enter or leave the panel are to be terminated on the Terminal Block 1 (TB1).
10. AC wiring for discrete Computer Control System signals that enter or leave the panel are to be terminated on Terminal Block 2 (TB2).
11. The terminal blocks (TB1, TB2 or ATB) can be mounted on the left or right side panels.
12. Provide a minimum of 10% spare terminal DIN rail space per terminal strip.
13. Signals from the field that enter the panel and only pass through the panel from the field to the Computer Control System require internal wiring from TB1 to TB2.
14. Arrange all control wiring associated with a particular piece of process equipment together on adjacent terminal blocks.
15. Identify wire number by the schematic rung numbers. Label TB1 and TB2 terminals with the rung number associated with the internal wire number connected to the terminal. Label ATB terminals in sequential order starting with the number 1. Identify analog shield terminations with an “SH” on the terminal block.
16. Multi-conductor cables of two pair or more shall have the outer cable insulation removed before entering the wireway.
17. Route all DC power and analog signals at a minimum of six inches from AC power and controls. When the six inch minimum distance is not available, provide a metallic barrier that extends 3” beyond the tallest wireway between the analog and discrete wireways.

H. Wireways:
1. Mount wireways from the internal panel components and terminal blocks with a minimum 2” spacing.
2. Arrange wireways to maintain a six inch minimum distance between analog and discrete circuit wiring.
3. Provide wireways for all field wiring. Arrange wireways to allow field wiring to enter from the top or bottom of the panel.
4. Align wireways between back and side panels.
5. Install a wireway on both sides of each terminal strip.
6. Size wireways to prevent conductor fill from exceeding 50% of the interior cross-sectional area of the wireway.
7. In addition to the above requirements, for ITP’s, wireways are not to be common for two terminal strips. Each terminal strip shall have a dedicated wireway on each side of the strip.

I. Control Logic:
1. The Start commands are to be designed utilizing normally open contacts from pushbuttons and/or the Computer Control System and shall be of a momentary signal that will require a seal circuit to maintain operation. Constant signals from positions switches are not allowed unless noted on the CONTRACT DRAWINGS.
2. All system failure, safety logic control devices or normal operations that are intended to cause the equipment to stop are to be wired in series with the start seal circuit. The unsealing of the start command on any fault or normal operation that causes the equipment to stop will require another start command to reseal.
3. Provide interlocks for the control functions of Local and Computer Modes in series with the Start and Stop logic. Provide a closed switch or relay contact to the Computer Control System to identify when the equipment is in Computer Mode.
4. Provide control logic of voltage 120 VAC.
5. Use power relays when control relay contacts are insufficient for the designated load.
6. Terminate the “Hot” conductor on the common of the switch or relay contact.
7. Control alarm logic shall be wired in a fail safe mode from the field device to the panel circuitry to alarm when a field wire has failed.

3.3 PANEL DRAWING DOCUMENTATION

A. General:
1. Files of the title block, panel symbols for front and internal sub-panel elevations, terminal strips, control schematics, analog loops, etc. are available in hard copy and AutoCAD .dwg format from the OWNER upon request through the ENGINEER via Example Panel Drawing Packages and Drawing Templates.

2. Provide drawing copies in the following format:
   a. Hard Copy - B Size - 11” X 17”
   b. Hard Copy - D Size - 22” X 34”
   c. Soft Copy in .DWG

3. The panel drawing documentation package consists of the following drawings types arranged in the following order.
   a. Cover Sheet
   b. Symbols and Legends 1 – Exterior and Interior Panel Symbols
   c. Symbols and Legends 2 – Schematic Symbols
   d. Front Panel Elevation
   e. Interior/Sub Panel Layout
   f. Terminal Strip Drawings
   g. Control Schematics
   h. Analog Loop Diagrams

4. Drawing Scale:
   a. Provide Front Elevation and Interior/Sub Panel Layout Drawings proportionately correct and to scale. Create all drawings on a D Size layout.

5. Border and Title Block:
   a. Provide each drawing with a border and title block information.
   b. Utilize the border and title block as provided in the Drawing Templates referenced in Section 3.3.A.1.

B. Panel Drawing Types:
   1. General:
      a. Provide a complete documentation package for each panel consisting of the drawings in the order listed in Section 3.3.A.3.
   2. Cover:
      a. Cover sheet for the panel documentation shall include the following information.
         1) Located on the left half of the sheet to include the Manufacturers Name, Address, Phone Number, Web Address, Project Reference Number and UL508A Certification Number.
         2) Located on the right half of the sheet include the title “City of Phoenix” “Water Service Department” and the project title, City of Phoenix project number, the panel full title, the panel abbreviation, the facility area in which the panel exists, submittal date, volume number and sheet count.
   3. Symbols & Legends
      a. Utilize the Symbols and Legend sheets as provided by the OWNER upon request from the ENGINEER.
      b. Additional symbols may be added if an existing symbol on the Symbol and Legend sheets does not exist.
4. Front Elevation Drawing
   a. The Front Elevation drawing illustrates the arrangement of the panel and position of the devices on the front face of the panel.
   b. Provide panel dimensions in inches. Provide dimensions for height, width, and depth. If the panel is small in size, the Front Elevation Drawing and Internal layout Drawing can be combined on one drawing.
   c. Provide the nameplate schedule on the Front Elevation drawing.
   d. Device Callouts
      1) Device callout hexagons are utilized to reference a device to the bill of materials. Place the bill of material item number inside the hexagon.
      2) Provide a leader from the hexagon that will point to the device.
      3) For a typical of multiple devices of the same type, only one device callout is necessary.
   e. Provide air conditioning heating and cooling information as provided by the Hoffman Temperature Calculation tool at:

5. Interior Sub Panel Layout:
   a. General:
      1) The Interior Sub Panel Layout drawing identifies the individual interior components and their physical location.
      2) Draw all components within the panel to scale.
      3) Include all interior sub panels if the panel has sub panels on the side walls.
   b. Provide the following information on the Interior Sub Panel Layout Drawing. Utilize the formats provided on the Drawing Templates. The information can be shown on a second sheet if needed to drawing clutter.
      1) Bill of Materials
         a) Include the devices on the Front Panel Elevation and the Interior Sub Panel(s) Elevation.
         b) Include items that are not specifically shown on the Front Panel Elevation or the Interior Sub Panel Layout drawing, such as wire, size and type, on the bill of materials.
         c) The utilization or insertion of Microsoft Excel files for the Bill of Materials is not allowed.
      2) Fuse Schedule
      3) Supplementary Protector Schedule
   c. Label and identify all devices, including terminal strips, relays, fuses, timers, power supplies and other special components on the drawing.
   d. For unique devices not shown on the Symbols and Legend Sheets, use rectangles and squares with the appropriate dimensions of the device.
   e. Device Callouts
      1) Device callout hexagons are utilized to reference a device to the bill of materials. Place the bill of material item number inside the hexagon.
      2) Provide a leader from the hexagon that will point to the device.
3) For a typical of multiple devices of the same type, only one device callout is necessary.

6. Terminal Strip Drawing:
   a. General:
      1) Terminal Strip Drawings provides locations for wiring terminations from field devices and other equipment external to the panel.
      2) Display the wiring connections exactly as they are physically installed. For example, if field wiring is terminated to the left side of the terminal strip, the terminal strip drawing displays the wiring connections to the left side of the terminal block.
      3) There are 5 different types of terminal strips and each has a specific function. The following is a brief description of each:
         a) For LCP’s and MCP’s:
            i. Power Terminal Block (PTB) – Power supply/supplies to the panel (120 VAC or higher). Identify terminal block number with the wire number assigned in the control logic drawings. Identify power sources with the originating panel, voltage and circuit number.
            ii. Field Wiring Discrete Signal Terminal Blocks (TB1) – Discrete field inputs and outputs to/from the panel. Identify terminal block number with the rung number assigned in the control logic drawings.
            iii. Field Wiring Discrete Signal Terminal Blocks (TB2) – Discrete inputs and outputs to/from the Computer Control System. Identify terminal block number with the rung number assigned in the control logic drawings.
            iv. Field Wiring Analog (ATB) or Internal Wiring DC Power Terminal Blocks - Field or Computer Control System Analog inputs and outputs to/from the panel, including 4-20 mA, 1-5 VDC, thermocouple or Resistance Temperature Detectors (RTD’s). Identify terminal block number with consecutive numbers starting with number 1. The shield wire terminal block is to be label “SH”.
         b) For ITP’s:
            i. TB-A thru Z – Discrete field inputs and outputs to/from the panel.
            ii. ATB-A thru Z – Analog inputs and outputs to/from the panel.

4) It is acceptable, if space available, to combine TB1, TB2, ATB and PTB on a single terminal strip drawing.

5) Identify spare terminals with an “SP” inside the rectangle.

6) Display terminals in the order they appear in the panel.

7) Place field wire labels on each line extending toward the terminal. Obtain this information from the cable and conduit schedules. If wire labels are unavailable, place seven “X’s” where wire tag normally resides. Provide this information prior to final deliverable of the Operations & Maintenance Manuals.
8) Signal description consists of 3 lines of text. Center the text next to the terminals.
   a) The 1st line of text lists the Equipment Name.
   b) The 2nd line of text is for the Signal Function.
   c) The 3rd line of text is the Signal Loop Number, if applicable.

7. Control Schematic:
   a. General:
      1) Control Schematics show the controls associated with pieces of process equipment and provide a visual depiction of the majority of control wiring.
   b. Control Schematic Components:
      1) Power Rail:
         a) Represent the power rail with two parallel vertical lines that extend vertically down the schematic.
         b) Each drawing includes two sets of power rails separated by 2.5”.
         c) Identify each power rail with the wire number such as L1 at the top and bottom of each power rail.
         d) The left power rail represents the “Hot” side of the power source. The right power rail represents the “Neutral” side of the power source.
      2) Power Source:
         a) Identify power source(s) with the originating panel, voltage and circuit number between the “Hot” terminal and “Neutral” terminal on the first rung of the portion of the schematic for each source.
         b) Indicate the terminals from the PTB providing the source and neutral powering the rail.
         c) A supplementary protector or fuse is displayed in the power rail directly below the power source (Hot) terminal. Label the supplementary protector or fuse with the supplementary protector or fuse number and current rating.
         d) Power layout for LCP’s:
            i. In the first portion of the schematic, display power to the general purpose receptacle and panel light.
            ii. In the second portion of the schematic, display power to the air conditioner and/or heater.
            iii. In the third portion of the schematic, display the power to the control logic.
         e) Power layout for MCP’s:
            i. The first portion is for the typical 480 VAC motor control circuit with starter and disconnect, the next sections are the same as for the LCP’s.
      3) Rung Number:
a) Rung numbers are used to identify the location and cross referencing of devices within the schematic and provide a practical means of labeling conductors and terminals within the panel.

b) Rung numbers are a sequential series of numbers starting with number 1. Locate the numbers vertically along the left side of the “Hot” power rail.

c) Rungs are to be spaced on 0.5” centers based on a D Sized drawing.

4) Wire Numbering:

a) On the downstream side of the first device on a rung, the wire number takes the rung number appearing to the left of the power rail. If a second device is located in the circuit, the wire number to the right of the second device takes the rung number, but is appended with an “A”. The wire number to the right of the third device is appended with a “B”, and so on.

b) When the electrical connection originated on the previous rung, the wire numbers continue to use the previous rung number as the base.

c) Connections to the power neutral rail take on the power neutral rail’s wire number N#.

5) Electrical Connections:

a) Represent electrical connections as a solid small circle where two or more wires interconnect.

b) Represent electrical connections as a hollow small circle where wires terminate to a device.

6) Electrical Wiring:

a) Electrical wires or circuits are represented by horizontal rungs that connect terminal blocks, relays, contacts and all other components used in the electrical schematic.

b) Space the schematic electrical wiring every other rung at a minimum.

c) Identify each wire with the rung number as the wire number.

d) Label each wire with the conductor insulation color below each electrical wire. Refer to Table 2.2.K.1.f.

e) Indicate electrical wiring that is external to the panel with dashed lines.

7) Device Labeling:

a) Device symbols in the schematic for field devices, pilot lights, switches, push buttons etc. requires two lines of text above the device and one line of text below the device to describe the usage of the device.

i. The first line of text above the device is the name of the equipment the device is associated with.

ii. The second line of text above the device is the control function of the device.

iii. The line of text under the device is the loop number.

b) Relay and timer symbol labels are to be identified with consecutive number starting with the number 1 or the rung number. For relay
coils and contacts, identify the relay base terminal connection. Normally open or normally closed contacts refer to the de-energized or “off the shelf” state.

c) Symbols in the schematic for contacts of relays, timers, etc. require two lines of text above the contact and two lines of text below the contact to describe the usage and coil reference of the contact.
   i. The first line of text above the contact is the name of the equipment the device is associated with.
   ii. The second line of text above the device is the control function of the device.
   iii. The first line of text under the device is the relay or timer number to reference the relay or timer in the schematic.
   iv. The second line of text under the device is the rung number of the relay or timer to reference where the relay or timer is located in the schematic. If using the rung number for the relay or timer coil, the rung number under the contact is not required.
   v. For relays and timer contact references, at the right of the neutral power rail, the schematic rung number location of all associated contacts is shown. If the contact is normally closed, underline the reference number. If a contact is unused, “SP” is shown.

8) Field Contacts:
   a) Show Field Contacts connected to their respective TB1 or TB2 Terminals.
   b) The connection lines from the contact to the terminal are dashed to designate they originate from outside the panel.

9) Selector Switches:
   a) Always show the switch in the far-left position, the switch contacts are shown as either opened or closed in this state. If they’re in the closed state, the contact is shown closed, indicated by a line shown below and touching the two side small circles. If the contact is open in this position, a line is drawn above the two side small circles, but not touching them.

   b) Show each position of the switch directly above its respective location on the switch. This indicates whether it is a two, three, four, or more position (pole) switch, and shows what the nameplate on each position will read.

   c) To indicate which positions the contact is closed, show a contact legend in parenthesis below and to the right of the contact. If the contact is closed in a position, an “X” is shown in the order of the contact position in which it is closed. If the contact is open in a position, an “O” is shown.

   d) When a selector switch is continued onto another sheet or further down on the same sheet, the continuation note is shown below the selector switch. Where the switch is continued, the same note appears, but on the top of the contact.
10) Push Buttons:
   a) Represent the push button contact in its “off the shelf” state.

11) Terminals:
   a) Terminal numbers are dependent upon the specific rung number that they appear in the schematic logic. As a horizontal electrical connection is followed from left to right, the first terminal number takes on the number of the rung. The second terminal number also takes the rung number but is appended by the letter A, the third by the letter B, and so on.

12) Programmable Logic Controller:
   a) Panels that contain a Programmable Logic Controller (PLC) require connection information for the PLC I/O modules.
      i. Utilize the PLC drawings as provided in the Drawing Templates referenced in Section 3.3.A.1.a.
   b) Module Layout:
      i. Represent the module with a 1 1/2” wide vertical rectangle with a length suitable to encompass a maximum of 16 channels or 8 analog per section based on type of module. Two cards can be shown per sheet.
      ii. Display field wiring (inputs) including TB1 and field device connections with a description on the left side of the module symbol.
      iii. Label the module with model number, input voltage, rack number and slot number above the module symbol.
      iv. Number each screw terminal per manufacturer’s data.
      v. Display the associated PLC register address with each signal.
      vi. Identify the positive and negative legs of the analog cable.
      vii. Include all required jumpers for signal type and all 120VAC and 24VDC power requirements.

13) 480 Volt Equipment:
   a) Provide the motor horsepower, full load amps and motor identification.

14) Contact Development:
   a) The last sheet of the control schematic displays contacts for internal panel relay contacts that connect with external field equipment or the Computer Control System (CCS).
   b) Organizes into two sections. The first section lists all contacts extending to the CCS. Title this section “Contacts to CCS”. The second section lists all contacts extending into the field equipment external to the panel. Title this section “Contacts to Field”. Group multiple contacts related to a single piece of equipment together.
   c) Each contact includes a signal description and its associated relay number and relay rung number location. Device signals require the appropriate symbol from the Schematic Legend Sheet.

8. Analog Loop Diagrams:
a. General:
   1) The analog loop diagram only displays the portion of the instrument loop that passes through a particular panel.
   2) The analog loop diagram displays the connections between field instruments, panels and the CCS.
   3) Analog loop diagrams are reserved for analog signals and control loops, but may be used to show complex connections for a particular instrument or device.
   4) Divide each loop into three different segments.
      a) The left segment is “FIELD” connections. This segment provides information on terminations external to the panel (i.e., connected panels, instrument transmitters). If the first segment is another panel, the panel name replaces the “FIELD” label.
      b) The center segment is the internal panel wiring and controls.
      c) The right segment information represents output or input signals to downstream panels or the CCS.
   5) Identify shield grounding location.
   6) Identify surge protection devices for each signal. Include surge protection for positive and negative leads. Utilize the surge protection block symbol from the legends and symbols sheet.
   7) Identify the cable number, wire color and polarity for each cable in the loop.

3.4 INSTALLATION

   A. Install equipment in conformance with NEC. Mounting panels on handrails is not allowed.

   B. Unless otherwise noted, install indoor free standing panels on 4-inch concrete pad. Extend pad 4-inches beyond outside dimensions of base, all sides. Lay grout after panel sills have been securely fastened down.

   C. Unless otherwise noted, install outdoor free standing panels on a reinforced concrete pedestal:
      1. Minimum Thickness: 8-inches with No. 4 steel reinforcing bars at 12-inches on centers, each way.
      2. Minimum Size: 4-inches larger than outer dimensions of base, all sides.
      3. Provide excavation and backfill work in conformance with Section 02315, Structural Excavation and Backfill.
      4. Provide concrete work in conformance with Section 03300, Cast-In-Place Concrete.
      5. Seal the contact surface between the panel base along the outside perimeter of the panel using RTV sealant.
      6. Install anchor bolts and anchor in accordance with Section 05051, Anchor Bolts, Toggle Bolts and Concrete Inserts.
D. Elevated Panels with floor stands:
   1. When installing conduits through bottom, utilize bushings to retain the NEMA rating of the panel.

E. Install each item in accordance with manufacturer’s recommendations and in accordance with the Contract Documents.

3.5 RECORD DRAWINGS:

   A. Maintain a set of red-line panel drawings to reflect changes or deviations that occur during installation, start-up and commissioning and incorporates these deviations into the final Operation & Maintenance Manual.

3.6 SPARE PARTS AND TEST EQUIPMENT

   A. Furnish and deliver the spare parts and test equipment as outlined below, identical and interchangeable with similar parts furnished under this Specification. Comply with the requirements of Section 01783, Spare Parts and Maintenance Materials.

   B. Pack spare parts in containers suitable for long term storage, bearing labels clearly designating the contents and the pieces of equipment for which they are intended.

   C. The following constitutes the minimum spare parts:
      1. Five of each type of control relay for each 40 or less furnished for this Contract.
      2. One replacement power supply for each type and size furnished for this Contract.
      3. One per ten (two, if fewer than twenty) of each type of panel mounted instrument including lights and pushbuttons.
      4. One dozen of each type and size of fuse used in panels and instruments.

   D. The following constitutes the minimum test and calibration equipment:
      1. All tooling required to insert, extract and connect any internal or external connector, including edge connectors.
      2. All special calibration equipment required for system calibration.

3.7 TESTING AND ADJUSTMENTS:

   A. Perform system testing and make any adjustments necessary in accordance with this Section and Section 17001, Process Control System General Requirements.

   B. Perform power supply, voltage adjustments to tolerances required by the appurtenant equipment.

   C. A Factory Acceptance Test shall be conducted before the panel is shipped to the site. The Factory Acceptance test shall be witnessed by the ENGINEER and OWNER. The Factory Acceptance Test Report listed in Specification Section 01331 – Reference Forms – Form 17260-A shall be utilized to document the test.
1. The following is a list of panels that require the Factory Acceptance Test to be witnessed by ENGINEER and OWNER:
   a. N/A

2. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required to perform factory testing, before shipment, at the manufacturer's facility to verify that system components are functioning properly and that they meet the functional and performance requirements of the Contract Documents.

3. Submit information on factory testing procedures to verify that testing shall fulfill the requirements as specified herein. Submittal shall be made at least two months in advance of any scheduled testing and shall include dates of scheduled tests.

4. Notify ENGINEER, in writing, at least four weeks before expected initiation of tests. OWNER and ENGINEER may elect to be present at CONTRACTOR’S facilities during operational test of system equipment, either for individual units or as an integrated system. Presence of OWNER and ENGINEER during testing does not relieve CONTRACTOR from conforming to the requirements of the Contract Documents and shall in no way imply acceptance of the equipment.

D. System Hardware Operational Testing
   1. All input/output devices and components shall be tested to verify operability and basic calibration.
   2. All system hardware components equipment shall be tested to verify proper operation of the equipment as stand alone units. Test shall include, but not be limited to, the following:
      a. AC/DC power checks.
      b. Power fail/restart tests.
      c. Diagnostics checks.
      d. Test demonstrating that all specified equipment functional capabilities are working properly.
      e. All system components shall be tested to verify that communication between units is working properly.

3.8 MANUFACTURER’S SERVICE

A. Provide the services of qualified factory-trained service representative to check and approve the installation of the panel(s).

B. The factory trained service representative shall be provided for installation supervision, start-up and testing services. The representative shall make a minimum of 2 visits to the site to approve the completed installation and to perform start-up testing of the equipment. The representative shall coordinate each visit with the ENGINEER prior to arrival on the site. The representative shall test operate the system in the presence of the ENGINEER and verify that the equipment conforms to
requirements. The representative shall revisit the job site as often as necessary until the installation and testing is entirely satisfactory.

C. The factory trained service representative shall be provided for operation and maintenance personnel training services. The representative shall make a minimum of 2 visits to the site to perform the services as described under Section 01821, Instruction of Operations and Maintenance Personnel. The representative shall coordinate each visit with the ENGINEER prior to arrival on the site.

D. For the factory trained service representative, all costs, including travel, lodging, meals and incidentals, shall be considered as included in the bid price.

E. Warranty: 1 year from final acceptance

++ END OF SECTION ++
GEOTECHNICAL EVALUATION
91ST AVENUE WASTEWATER TREATMENT PLANT (WWTP)
SLUDGE SOLAR DRYING BEDS - WS 90100098
PHOENIX, ARIZONA

PREPARED FOR:
Stantec
8211 South 48th Street
Phoenix, Arizona 85044

PREPARED BY:
Ninyo & Moore
Geotechnical and Environmental Sciences Consultants
3202 East Harbour Drive
Phoenix, Arizona 85034

August 5, 2016
Project No. 605022001
August 5, 2016
Project No. 605022001

Mr. Chris Simko, P.E.
Stantec
8211 South 48th Street
Phoenix, Arizona 85044

Subject: Geotechnical Evaluation
91st Avenue Wastewater Treatment Plant
Sludge Solar Drying Beds - WS 90100098
Phoenix, Arizona

Dear Mr. Simko:

In accordance with our proposal dated January 20, 2016, Ninyo & Moore has performed a geotechnical evaluation for the above-referenced site. The attached report presents our methodology, findings, conclusions, and recommendations regarding the geotechnical conditions at the project site.

We appreciate the opportunity to be of service to you during this phase of the project.

Sincerely,

NINYO & MOORE

Kenneth Rush, III, PE
Senior Project Engineer

Donald Tharp, PE
Principal Engineer

KR/DT/tlp

Distribution: (1) Addressee (Electronic Copy)
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1. INTRODUCTION

In accordance with our proposal dated January 20, 2016, and your authorization, we have performed a geotechnical evaluation for 91st Avenue Wastewater Treatment Plant (WWTP) Sludge Solar Drying Beds project located in Phoenix, Arizona. The purpose of our evaluation was to assess the subsurface conditions at the project site in order to formulate geotechnical recommendations for design and construction. This report presents the results of our evaluation and our geotechnical conclusions and recommendations regarding the proposed construction.

2. SCOPE OF SERVICES

The scope of our services for the project generally included:

- Reviewing readily available aerial photographs, as-built documents, and published geologic literature, including maps and reports pertaining to the project site and vicinity.
- Obtaining appropriate City of Phoenix (COP) right of way and/or permissions to conduct the field work.
- Conducting a geologic reconnaissance of the project site, selection, and marking out of proposed boring locations.
- Notifying Arizona 811 for underground utility clearance prior to drilling.
- Drilling, logging, and sampling of seven small-diameter exploratory borings to depths of approximately 10 feet below ground surface (bgs). The boring logs are presented in Appendix A.
- Performing laboratory tests of selected samples obtained from the borings to evaluate in-situ moisture content and dry density, gradation, Atterberg limits, consolidation (response-to-wetting), and corrosivity characteristics (including pH, minimum electrical resistivity, and soluble sulfate and chloride contents). The results of the laboratory testing are presented on the boring logs and/or in Appendix B.
- Preparing this report presenting our findings, conclusions, and recommendations regarding the design and construction of the project.

Our scope of services did not include environmental consulting services such as hazardous waste sampling or analytical testing at the site. A detailed scope of services and estimated fee for such services can be provided upon request.
3. SITE DESCRIPTION

The project site is located in Section 27, Township 1 North, Range 1 East, near the northeast corner of the 91st Avenue WWTP located near South 83rd Avenue and Sunland Avenue in Phoenix, Arizona. The approximate location of the site is depicted on Figure 1. At the time of our evaluation, the project site consisted of three existing unpaved, inactive drying beds at WWTP designated as sludge drying bed No. 31, No. 57 and No. 58. The site was surrounded by agricultural land. The Salt River is situated approximately ¼-mile south of the site.

According to the Fowler, Arizona-Maricopa County, 7.5-Minute United States Geological Survey (USGS) Topographic Quadrangle Maps (2014), the site elevation ranges from approximately 990 feet relative to mean sea level (MSL) to 980 feet MSL. Based on the information from these quadrangle maps, the surrounding regional topography of the project site slopes gently from the northeast down to the southwest towards the Salt River.

Historic aerial photographs from the Flood Control District of Maricopa County (FCDMC) were reviewed for this project. Aerial photographs from 1937, 1949 and 1953 depicted the project site as being agricultural land. An aerial photograph from 1959 depicted limited treatment facilities near 87th Avenue and, photographs from 1976 and 1979 depicted significant expansion of the treatment plant with various tanks and basins. Aerial photographs from 1986 and 1993 depict more expansion to the west, extending to 91st Avenue and to the north of West Sunland Avenue. Aerial photographs dated 1999 to 2009 and later depict the project site as being an active WWTP with paved access roads, surrounded by agricultural land, and continued expansion of the treatment plant to east of 87th Street and north of West Sunland Avenue. Aerial photographs from 2009 to 2013 depict the project site as being similar to its current conditions.

4. PROJECT DESCRIPTION

This project generally includes the design and construction of several sludge solar drying beds within the existing WWTP. The existing solar drying beds, designated as solar drying beds No. 31, 57 and 58, will be paved with asphalt concrete pavement and re-designated as solar drying
beds No. 31, 57A, 57B, 58A and 58B. We understand that excavation on the order of 1 to 2 feet is anticipated in connection with the project.

5. **FIELD EXPLORATION AND LABORATORY TESTING**

On June 23, 2016, Ninyo & Moore conducted a subsurface evaluation at the site in order to evaluate the existing subsurface conditions and to collect soil samples for laboratory testing. Our evaluation consisted of the drilling, logging, and sampling of seven small-diameter borings, denoted as B-1 through B-7. The borings were advanced using a CME-75 truck-mounted drill rig equipped with hollow-stem augers to approximately 10 to 20 feet bgs. The approximate locations of the borings are shown on Figure 2. Bulk and relatively undisturbed soil samples were collected at selected intervals. Descriptions of the soils encountered are presented on the boring logs in Appendix A.

The soil samples collected from our drilling activities were transported to the Ninyo & Moore laboratory in Phoenix, Arizona for geotechnical laboratory analysis. The analyses included in-situ moisture content and dry density, gradation, Atterberg limits tests, consolidation (response-to-wetting), and corrosivity characteristics (including pH, minimum electrical resistivity, and soluble sulfate and chloride contents). The results of the in-situ moisture content and dry density testing are presented on the boring logs in Appendix A. A description of each laboratory test method and the remainder of the test results are presented in Appendix B.

6. **GEOLOGY AND SUBSURFACE CONDITIONS**

The geology and subsurface conditions at the site are described in the following sections.

6.1. **Geologic Setting**

The project site is located in the Sonoran Desert Section of the Basin and Range physiographic province, which is typified by broad alluvial valleys separated by steep, discontinuous, subparallel mountain ranges. The mountain ranges generally trend north-south and northwest-southeast. The basin floors consist of alluvium with thickness extending to several thousands of feet.
The basins and surrounding mountains were formed approximately 10 to 18 million years ago during the mid- to late-Tertiary. Extensional tectonics resulted in the formation of horsts (mountains) and grabens (basins) with vertical displacement along high-angle normal faults. Intermittent volcanic activity also occurred during this time. The surrounding basins filled with alluvium from the erosion of the surrounding mountains as well as from deposition from rivers. Coarser-grained alluvial material was deposited at the margins of the basins near the mountains.

The surficial geology of the site is described as Holocene age (<10,000 years) alluvial deposits associated with the Salt River (Demsey, 1989). These deposits typically consist of clay, silt, sand, gravel, and cobbles with possible boulders. Stage I to Stage II calcic horizons have developed within this unit. The United States Department of Agriculture web soil survey describes the soil as the Glenbar Loam, which consists of clay loam. Descriptions of the soils encountered during our evaluation are presented in the following section.

6.2. Subsurface Conditions

Our knowledge of the subsurface conditions at the project site is based on our field exploration, laboratory testing, and our understanding of the general geology of the area. The following sections provide generalized descriptions of the materials encountered. More detailed descriptions are presented on the boring logs in Appendix A.

6.2.1. Fill

Fill was encountered at the surface, and extended to approximately 3 to 6 feet bgs in our borings. The fill material generally consisted of stiff to very stiff sandy clay (CL) and sandy silt (ML), and medium dense to dense clayey sand (SC) in our borings.

6.2.2. Alluvium

Alluvium was encountered at the surface or beneath the fill described above, and extended to the termination depths of our borings. The alluvium generally consisted of hard sandy lean clay with little sand and few cobbles, and very loose to dense clayey sand, silty sand, and poorly graded sand in our borings. Very loose to loose soils were
encountered near the groundwater level in boring B-4. Varying amounts of gravel were encountered in our borings, as well as caliche nodules.

6.3. Groundwater

Groundwater was encountered at a depth of 13 feet in boring B-4 at completion of drilling. Based on well data from the Arizona Department of Water Resources (ADWR), the approximate depth to groundwater has been estimated to be as shallow as 15 feet bgs and is consistent with groundwater encountered in boring B-4. However, groundwater levels can fluctuate due to seasonal variations, irrigation, groundwater withdrawal or injection, flows in the Salt River, and other factors.

7. GEOLOGIC HAZARDS

The following sections describe potential geologic hazards at the site, including land subsidence and earth fissures, and faulting.

7.1. Land Subsidence and Earth Fissures

Groundwater depletion, due to groundwater pumping, has caused land subsidence and earth fissures in numerous alluvial basins in Arizona. It has been estimated that subsidence has affected more than 3,000 square miles and has caused damage to a variety of engineered structures and agricultural land (Schumann and Genualdi, 1986). From 1948 to 1983, excessive groundwater withdrawal has been documented in several alluvial valleys where groundwater levels have been reportedly lowered by up to 500 feet. With such large depletions of groundwater, the alluvium has undergone consolidation resulting in large areas of land subsidence.

In Arizona, earth fissures are generally associated with land subsidence and pose an ongoing geologic hazard. Earth fissures generally form near the margins of geomorphic basins where significant amounts of groundwater depletion have occurred. Reportedly, earth fissures have also formed due to tensional stress caused by differential subsidence of the unconsolidated alluvial materials over buried bedrock ridges, irregular bedrock surfaces, and facies changes within the unconsolidated alluvial material (Schumann and Genualdi, 1986).
Based on our field reconnaissance and review of the referenced material, there are no known earth fissures underlying the subject site. Based on our research, the closest earth fissure to the site is located approximately 11.7 miles to the northwest of the project site (Arizona Geological Survey [AZGS], 2016). Continued groundwater withdrawal in the area may result in further subsidence and the formation of new fissures or the extension of existing fissures. In general, earth fissures are not expected to be a constraint to the construction of this project.

7.2. Faulting
The site lies within the Sonoran zone, which is a relatively stable tectonic region located in southwestern Arizona, southeastern California, southern Nevada, and northern Mexico (Euge et al., 1992). This zone is characterized by sparse seismicity and few Quaternary faults. Based on our field observations, review of pertinent geologic data, and analysis of aerial photographs, faults are not located on or adjacent to the property. The closest fault to the site is the Carefree fault zone, located approximately 35 miles to the northeast of the site (Pearthree, 1998). Approximately 2 meters of displacement has occurred along this fault within middle Pleistocene deposits (<750,000 years), but the upper Pleistocene and Holocene deposits (<250,000 years) are not displaced. Seismic parameters recommended for the design of the proposed improvement are presented in Section 9.2.

8. CONCLUSIONS
Based on the results of our subsurface evaluation, laboratory testing, and data analysis, it is our opinion that the proposed construction is feasible from a geotechnical standpoint, provided that the recommendations of this report are incorporated into the design and construction of the proposed project, as appropriate. Geotechnical considerations include the following:

- The on-site soils should generally be excavatable to reasonable foundation depths with conventional earthmoving construction equipment in good working condition. However, gravel and caliche nodules were encountered in our borings that may call for more aggressive excavation techniques depending on the particle size and degree of cementation encountered.
Based on the results of the field and laboratory evaluations, it is our opinion that pavements, and exterior concrete flatwork be founded on a zone of moisture-conditioned and compacted engineered fill.

Areas of loose to very loose, cohesionless, granular, alluvium exists onsite near groundwater level encountered. These soils could have a potential for caving and sloughing during excavation, especially if the soils are wet or saturated.

Imported soils and soils generated from on-site excavation activities that exhibit a relatively low plasticity can generally be used as engineered fill.

An earthwork (shrinkage) factor of 10 to 20 percent for the on-site soils is estimated.

Groundwater was encountered at a depth of 13 feet in boring B-4. Groundwater levels can fluctuate due to the proximity of the Salt River, seasonal variations, irrigation, groundwater withdrawal or injection, and other factors.

No known or documented geologic hazards are present underlying, or adjacent to the site.

9. RECOMMENDATIONS
The following sections present our geotechnical recommendations for the proposed construction. If the proposed construction is changed from that discussed in this report, Ninyo & Moore should be contacted for additional recommendations.

9.1. Earthwork
The following sections provide our earthwork recommendations for this project. In general, the earthwork specifications contained in Maricopa Association of Governments (MAG), Uniform Standard Specifications and Details for Public Works Construction, as amended by the COP, are expected to apply, except as noted.

9.1.1. Excavations
Our evaluation of the excavation characteristics of the on-site materials is based on the results of our exploratory borings, our site observations, and our experience with similar materials. In our opinion, excavation of the on-site materials can generally be accomplished to the expected foundation depths with conventional earthmoving equipment in good operating condition. In addition, gravel and scattered caliche nodules were encountered in our borings, and cobbles and possible boulders should be
anticipated. These materials could be more difficult to excavate, and may slow the excavation rate, depending on the particle size and actual degree of cementation encountered during construction.

The contractor should provide safely sloped excavations or an adequately constructed and braced shoring system, in compliance with Occupational Safety and Health Administration (OSHA) requirements for employees working in an excavation that may expose them to the danger of moving ground. If material is stored or equipment is operated near an excavation, stronger shoring should be used to resist the extra pressure due to superimposed loads.

9.1.2.  Grading, Fill Placement, and Compaction
Vegetation and debris from the clearing operation, as well as demolition debris, should be removed from the site and disposed of at a legal dumpsite. Obstructions that extend below finish grade should be expected by the contractor and should be removed and the resulting holes filled with moisture-conditioned and compacted soil.

Prior to placement of fill or other construction, Ninyo & Moore should carefully evaluate the exposed grade for any areas of soft, loose, or wet soils. Drying or overexcavation of some materials may be appropriate.

On-site and imported soils that exhibit relatively low plasticity indices are generally suitable for re-use as engineered fill. Relatively low plasticity indices are defined as a Plasticity Index ([PI] by the American Society for Testing and Materials [ASTM] D 4318) value of 15 or less. The Atterberg limits tests performed on selected soil samples resulted in a PI ranging from 0 (non-plastic) to 18. As such, it is our opinion that some of the on-site soils may be suitable for re-use as engineered fill during construction. Additional field sampling and laboratory testing to evaluate the suitability of the on-site soils should be conducted during construction activities to evaluate the acceptability of on-site soils.
In addition to the above recommendations, suitable fill should not include organic material, construction debris, or other non-soil fill materials. Rock or clay particles should not be larger than 4 inches in dimension. Unsuitable fill material should be disposed of off-site or in non-structural areas.

As stated previously, our borings disclosed alluvial deposits consisting primarily of lean clay with sand, clayey sand, and silty sand with varying consistencies and relative densities. Accordingly, we recommend that new pavements and flatwork be supported on 12 inches of moisture-conditioned and compacted engineered fill. This improved zone can either be improved by overexcavation or scarification. The fill thickness should be measured from the bottom of the base material and should be compacted by appropriate mechanical methods to 95 percent relative compaction, as evaluated by ASTM D 698 at a moisture content generally above its optimum. The remedial grading below these areas should extend laterally 1 foot or more horizontally beyond the slab/pavement footprint.

Following the remedial grading as described above, and prior to the placement of new fill, the resulting exposed surface should be carefully evaluated by Ninyo & Moore for the presence of soft, loose, wet, or fill soils that were not removed as part of the remedial grading process. Based on this evaluation, additional remediation may be needed. This could include scarification of the exposed surface. This additional remediation, if needed, should be addressed by Ninyo & Moore during the earthwork operations. An earthwork (shrinkage) factor of 10 to 20 percent for the on-site soils is estimated.

9.1.3. **Imported Fill Material**
Imported fill, if utilized, should consist of granular material with a PI of less than 15. Import material in contact with ferrous metals should preferably have low corrosion potential (minimum resistivity more than 2,000 ohm-cm, chloride content less than 25 parts per million [ppm]). In lieu of this, ferrous materials may be protected from corrosion through cathodic protection, pipe wrapping, etc. Import material in contact
with concrete should have a soluble sulfate content of less than 0.1 percent. Ninyo & Moore should evaluate such materials and details of their placement prior to importation.

9.2. Seismic Design Parameters

Design of the proposed improvements should be performed in accordance with the requirements of the governing jurisdictions and applicable building codes. Table 1 presents the seismic design parameters for the site in accordance with the 2012 International Building Code (IBC) guidelines and adjusted maximum considered earthquake (MCE) spectral response acceleration parameters evaluated using the USGS 2016 ground motion calculator (web-based):

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<th>Value</th>
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<td>Site Class</td>
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<td>Site Coefficient, F_a</td>
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<tr>
<td>Site Coefficient, F_v</td>
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<td>Mapped Spectral Response Acceleration at 0.2-second Period, S_s</td>
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<tr>
<td>Mapped Spectral Response Acceleration at 1.0-second Period, S_1</td>
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<tr>
<td>Spectral Response Acceleration at 0.2-second Period Adjusted for Site Class, S_{MS}</td>
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<tr>
<td>Spectral Response Acceleration at 1.0-second Period Adjusted for Site Class, S_{M1}</td>
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<tr>
<td>Design Spectral Response Acceleration at 0.2-second Period, S_{DS}</td>
<td>0.129 g</td>
</tr>
<tr>
<td>Design Spectral Response Acceleration at 1.0-second Period, S_{D1}</td>
<td>0.062 g</td>
</tr>
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9.3. Pavements

For the paved areas, we understand that asphalt concrete (AC) sections will be considered and each bed will need to withstand approximately 40 trucks per day, three days per week during loading mode. The design truck is 25 ton (net) with a gross vehicle weight of 40 ton, 4 axle. The rest of the week drying bed is in drying mode and there will be a tractor. The drying beds are loaded once every three weeks. When calculated on an average basis, the beds will experience around 6 trucks per day. The design parameters for these pavement
sections should include a 20-year design life and an equivalent single axle loading (ESAL) of 18 kips. On an average basis and assuming the growth factor varies between 0% and 4%, a traffic load of 34,000 to 61,000 ESALs and a structural number (SN) of 2.0 to 2.2 is anticipated. However, due the concentrated heavy loading anticipated during the bed loading cycles, a SN of 2.88 is recommended. The pavement sections given below are based on an estimated soil R-value of 13 for the subgrade soils below the recommended improvements as described in Section 9.1.2 of this report.

An asphalt pavement section consisting of 5 inches or more of plant-mix AC (per MAG Section 710) over 8 or more inches of graded AB can be considered can be utilized. We recommend the underlying subgrade soils be prepared as described in Section 9.1.2 of this report. AB material should be compacted to a relative compaction of 100 percent of the maximum dry density, as evaluated by ASTM D 698, at moisture content generally near its optimum.

9.4. Concrete Flatwork
To reduce the potential manifestation of distress to exterior concrete flatwork due to movement of the underlying soil, we recommend that such flatwork be installed with crack-control joints at appropriate spacing as designed by the structural engineer. We recommend that exterior concrete flatwork, if any, be supported on engineered fill as described in Section 9.1.2 of this report. Positive drainage should be established and maintained adjacent to flatwork.

If flatwork is installed adjacent existing structures, we recommend that a flexible sealant be applied at the joints where flatwork abuts building foundations, as well as in control joints that exhibit post-construction cracking to reduce the introduction of moisture adjacent to the foundations. The flexible sealant should be installed and maintained in accordance with the manufacturer’s recommendations.
9.5.  Corrosion

The corrosion potential of the on-site materials was analyzed to evaluate its potential effect on the foundations and structures. Corrosion potential was evaluated using the results of laboratory testing of a sample obtained during our subsurface evaluation that was considered representative of soils at the subject site.

Laboratory testing consisted of pH, minimum electrical resistivity, and chloride and soluble sulfate contents. The pH and minimum electrical resistivity tests were performed in general accordance with Arizona Test 236c, while sulfate and chloride tests were performed in general accordance with Arizona Test 733 and 736, respectively. The results of the corrosivity tests are presented in Appendix B.

The soil pH value of the selected sample tested was 8.0 and 8.1, which is considered to be alkaline. The minimum electrical resistivity measured in the laboratory was 440 and 570 ohm-cm, which is considered to be corrosive to ferrous materials. The chloride content of the sample tested was measured to be 121 and 280 ppm, which is also considered to be corrosive to ferrous materials. The soluble sulfate content of the soil sample was measured to be 0.078 and 0.120 percent, which is considered to represent negligible to moderate sulfate exposure to concrete.

Special consideration should be given to the use of heavy-gauge, corrosion-protected, underground steel pipe or culverts, if any are planned. As an alternative, plastic pipe or reinforced concrete pipe could be considered. Also, buried utilities of different metallic construction and/or operating temperatures should be electrically isolated from each other to minimize galvanic corrosion problems. In addition, new piping should be electrically isolated from old piping so that the old metal will not increase the corrosion rate of the new metal. A corrosion specialist should be consulted for further recommendations.
9.6. **Concrete**

Laboratory chemical tests performed on a selected sample indicated a sulfate content of up to 0.120 percent by weight. Based on the American Concrete Institute (ACI), the on-site soils should be considered to have a negligible to moderate sulfate exposure to concrete.

Notwithstanding the sulfate test results and due to the limited number of chemical tests performed, as well as our experience with similar soil conditions and local practice, we recommend the use of Type II cement for construction of concrete structures at this site. Due to potential uncertainties as to the use of reclaimed irrigation water, or topsoil that may contain higher sulfate contents, pozzolan or admixtures designed to increase sulfate resistance may be considered.

The concrete should have a water-cementitious materials ratio no more than 0.5 by weight for normal weight aggregate concrete. The structural engineer should select the concrete design strength based on the project specific loading conditions. Higher strength concrete may be selected for increased durability and resistance to slab curling and shrinkage cracking.

9.7. **Site Drainage**

Surface drainage should be provided to divert water away from structures and paved surfaces. Surface water should not be permitted to drain toward the structures or to pond adjacent to or on pavement areas. Positive drainage for this project is defined as a slope of 2 or more percent for a distance of 5 or more feet away from the structures. Downspouts should discharge to drainage systems away from structures, pavements, and flatwork. Soil improvements below the pavement sections should be sloped from the center toward the edges of these areas.

9.8. **Pre-Construction Conference**

We recommend that a pre-construction conference be held. Representatives of the owner, civil engineer, Ninyo & Moore, and the contractor should be in attendance to discuss the
project plans and schedule. Our office should be notified if the project description included herein is incorrect, or if the project characteristics are significantly changed.

9.9. Construction Observation and Testing
During construction operations, we recommend that Ninyo & Moore perform observation and testing services for the project. These services should be performed to evaluate exposed subgrade conditions, including the extent and depth of overexcavation, to evaluate the suitability of proposed borrow materials for use as fill and to observe placement and test compaction of fill soils. If another geotechnical consultant is selected to perform observation and testing services for the project, we request that the selected consultant provide a letter to the owner, with a copy to Ninyo & Moore, indicating that they fully understand our recommendations and that they are in full agreement with the recommendations contained in this report. Qualified subcontractors utilizing appropriate techniques and construction materials should perform construction of the proposed improvements.

10. LIMITATIONS
The field evaluation, laboratory testing, and geotechnical analyses presented in this geotechnical report have been conducted in general accordance with current practice and the standard of care exercised by geotechnical consultants performing similar tasks in the project area. No warranty, expressed or implied, is made regarding the conclusions, recommendations, and opinions presented in this report. There is no evaluation detailed enough to reveal every subsurface condition. Variations may exist and conditions not observed or described in this report may be encountered during construction. Uncertainties relative to subsurface conditions can be reduced through additional subsurface exploration. Additional subsurface evaluation will be performed upon request. Please also note that our evaluation was limited to assessment of the geotechnical aspects of the project, and did not include evaluation of structural issues, environmental concerns, or the presence of hazardous materials.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Ninyo & Moore
should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document.

This report is intended for design purposes only. It does not provide sufficient data to prepare an accurate bid by contractors. It is suggested that the bidders and their geotechnical consultant perform an independent evaluation of the subsurface conditions in the project areas. The independent evaluations may include, but not be limited to, review of other geotechnical reports prepared for the adjacent areas, site reconnaissance, and additional exploration and laboratory testing.

Our conclusions, recommendations, and opinions are based on an analysis of the observed site conditions. If geotechnical conditions different from those described in this report are encountered, our office should be notified and additional recommendations, if warranted, will be provided upon request. It should be understood that the conditions of a site could change with time as a result of natural processes or the activities of man at the subject site or nearby sites. In addition, changes to the applicable laws, regulations, codes, and standards of practice may occur due to government action or the broadening of knowledge. The findings of this report may, therefore, be invalidated over time, in part or in whole, by changes over which Ninyo & Moore has no control.

This report is intended exclusively for use by the client. Any use or reuse of the findings, conclusions, and/or recommendations of this report by parties other than the client is undertaken at said parties’ sole risk.
11. REFERENCES

American Concrete Institute (ACI), Building Code Requirements for Structural Concrete (ACI 318-05) and Commentary (ACI 318R).

American Concrete Institute (ACI), Guidelines for Concrete Floor and Slab Construction (ACI 302.1R).

American Concrete Institute (ACI), Guidelines for Residential Cast-in-Place Concrete Construction (ACI 332R).


Maricopa Association of Governments (MAG), Uniform Standard Specifications and Details for Public Works Construction.

Ninyo & Moore, In-house proprietary information.

Occupational Safety and Health Administration (OSHA), Title 29 of the Code of Federal Regulations (CFR), Part No. 1926 - Safety and Health Regulations for Construction, Subpart P - Excavations.


United States Geological Survey (USGS), 2014, Fowler -Arizona, Maricopa County, 7.5-Minute Series (Topographic): scale 1:24,000.

### Aerial Photographs Reviewed

<table>
<thead>
<tr>
<th>Source</th>
<th>Photo Date</th>
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Approximate Site Location


Note: Dimensions, directions, and locations are approximate.
APPENDIX A

BORING LOGS

Field Procedure for the Collection of Disturbed Samples
Disturbed soil samples were obtained in the field using the following methods.

Bulk Samples
Bulk samples of representative earth materials were obtained from the exploratory borings. The samples were bagged and transported to the laboratory for testing.

The Standard Penetration Test (SPT) Sampler
Disturbed drive samples of earth materials were obtained by means of a Standard Penetration Test sampler. The sampler is composed of a split barrel with an external diameter of 2 inches and an unlined internal diameter of 1-3/8 inches. The sampler was driven into the ground 12 to 18 inches with a 140-pound hammer falling freely from a height of 30 inches in general accordance with ASTM D 1586. The blow counts were recorded for every 6 inches of penetration; the blow counts reported on the logs are those for the last 12 inches of penetration. Soil samples were observed and removed from the sampler, bagged, sealed and transported to the laboratory for testing.

Field Procedure for the Collection of Relatively Undisturbed Samples
Relatively undisturbed soil samples were obtained in the field using the following methods.

The Modified Split-Barrel Drive Sampler
The sampler, with an external diameter of 3.0 inches, was lined with 1-inch long, thin brass rings with inside diameters of approximately 2.4 inches. The sample barrel was driven into the ground with the weight of a hammer or the Kelly bar of the drill rig in general accordance with ASTM D 3550. The driving weight was permitted to fall freely. The approximate length of the fall, the weight of the hammer or bar, and the number of blows per foot of driving are presented on the boring logs as an index to the relative resistance of the materials sampled. The samples were removed from the sample barrel in the brass rings, sealed, and transported to the laboratory for testing.
### Soil Classification Chart per ASTM D 2488

#### Primary Divisions

<table>
<thead>
<tr>
<th>Coarse-Grained Soils</th>
<th>Secondary Divisions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean Gravel less than 5% fines</td>
<td>GW</td>
</tr>
<tr>
<td>Gravel with Dual Classifications</td>
<td>GW-GM</td>
</tr>
<tr>
<td>Gravel with Fines more than 12% fines</td>
<td>GM</td>
</tr>
<tr>
<td>Clean Sand less than 5% fines</td>
<td>SW</td>
</tr>
<tr>
<td>Sand with Dual Classifications</td>
<td>SW-SM</td>
</tr>
<tr>
<td>Sand with Fines more than 12% fines</td>
<td>SM</td>
</tr>
<tr>
<td>Clean Gravel</td>
<td>GW</td>
</tr>
<tr>
<td>Gravel with Dual Classifications</td>
<td>GW-GM</td>
</tr>
<tr>
<td>Gravel with Fines more than 12% fines</td>
<td>GM</td>
</tr>
<tr>
<td>Clean Sand</td>
<td>SW</td>
</tr>
<tr>
<td>Sand with Dual Classifications</td>
<td>SW-SM</td>
</tr>
<tr>
<td>Sand with Fines more than 12% fines</td>
<td>SM</td>
</tr>
<tr>
<td>Clean Gravel</td>
<td>GW</td>
</tr>
<tr>
<td>Gravel with Dual Classifications</td>
<td>GW-GM</td>
</tr>
<tr>
<td>Gravel with Fines more than 12% fines</td>
<td>GM</td>
</tr>
<tr>
<td>Clean Sand</td>
<td>SW</td>
</tr>
<tr>
<td>Sand with Dual Classifications</td>
<td>SW-SM</td>
</tr>
<tr>
<td>Sand with Fines more than 12% fines</td>
<td>SM</td>
</tr>
<tr>
<td>Clean Gravel</td>
<td>GW</td>
</tr>
<tr>
<td>Gravel with Dual Classifications</td>
<td>GW-GM</td>
</tr>
<tr>
<td>Gravel with Fines more than 12% fines</td>
<td>GM</td>
</tr>
<tr>
<td>Clean Sand</td>
<td>SW</td>
</tr>
<tr>
<td>Sand with Dual Classifications</td>
<td>SW-SM</td>
</tr>
<tr>
<td>Sand with Fines more than 12% fines</td>
<td>SM</td>
</tr>
</tbody>
</table>

#### Fine-Grained Soils

<table>
<thead>
<tr>
<th>Silty and Clay liquid limit less than 50%</th>
<th>Inorganic</th>
</tr>
</thead>
<tbody>
<tr>
<td>CL</td>
<td>Lean Clay</td>
</tr>
<tr>
<td>ML</td>
<td>Silty Clay</td>
</tr>
<tr>
<td>CL-ML</td>
<td>Silty Clay</td>
</tr>
<tr>
<td>Ceramic or Organic Clay</td>
<td>OL (Plasticity Index (PI) &gt; 4)</td>
</tr>
<tr>
<td>OL (PI &lt; 4)</td>
<td>Organic Silty Clay</td>
</tr>
<tr>
<td>Organic</td>
<td>OL (Plasticity Index (PI) &lt; 4)</td>
</tr>
<tr>
<td>OH (plots on or above 'A'-line)</td>
<td>Organic Clay</td>
</tr>
<tr>
<td>OH (plots below 'A'-line)</td>
<td>Organic Silty Clay</td>
</tr>
</tbody>
</table>

#### Grain Size

- **Boulders**: > 12" > 12" Larger than basketball-sized
- **Cobbles**: 3 - 12" 3 - 12" Fist-sized to basketball-sized
- **Gravel**: 3/4 - 3" 3/4 - 3" Thumb-sized to fist-sized
- **Sand**: #4 - 3/4" 0.19 - 0.75" Pea-sized to thumb-sized
- **Sand**: #10 - 4" 0.079 - 0.19" Rock-salt-sized to pea-sized
- **Sand**: #200 - #400 0.0029 - 0.017" Flour-sized to rock-salt-sized
- **Fines**: Passing #200 < 0.0029" Flour-sized and smaller

---

### Plasticity Chart

#### Liquid Limit (LL), %

<table>
<thead>
<tr>
<th>LL</th>
<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
</tr>
</thead>
<tbody>
<tr>
<td>LL</td>
<td>CL or OL</td>
<td>CH or OH</td>
<td>ML or OL</td>
<td>MH or OH</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Consistency - Fine-Grained Soil

<table>
<thead>
<tr>
<th>Consistency</th>
<th>SPT (blows/foot)</th>
<th>Modified Split Barrel (blows/foot)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Soft</td>
<td>&lt; 2</td>
<td>&lt; 3</td>
</tr>
<tr>
<td>Soft</td>
<td>2 - 4</td>
<td>3 - 5</td>
</tr>
<tr>
<td>Firm</td>
<td>5 - 8</td>
<td>6 - 10</td>
</tr>
<tr>
<td>Stiff</td>
<td>9 - 15</td>
<td>11 - 20</td>
</tr>
<tr>
<td>Very Stiff</td>
<td>16 - 30</td>
<td>21 - 39</td>
</tr>
<tr>
<td>Hard</td>
<td>&gt; 30</td>
<td>&gt; 39</td>
</tr>
</tbody>
</table>

#### Apparent Density - Coarse-Grained Soil

<table>
<thead>
<tr>
<th>Apparent Density</th>
<th>Spooling Cable or Cathead</th>
<th>Automatic Trip Hammer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Loose</td>
<td>≤ 4</td>
<td>≤ 8</td>
</tr>
<tr>
<td>Loose</td>
<td>5 - 10</td>
<td>9 - 21</td>
</tr>
<tr>
<td>Medium Dense</td>
<td>11 - 30</td>
<td>22 - 63</td>
</tr>
<tr>
<td>Dense</td>
<td>31 - 50</td>
<td>64 - 105</td>
</tr>
<tr>
<td>Very Dense</td>
<td>&gt; 50</td>
<td>&gt; 105</td>
</tr>
</tbody>
</table>

#### USCS Method of Soil Classification

**Explanation of USCS Method of Soil Classification**

**PROJECT NO.** | **DATE** | **FIGURE**
<table>
<thead>
<tr>
<th>DEPTH (feet)</th>
<th>Bulk SAMPLES</th>
<th>BLOWS/FOOT</th>
<th>MOISTURE (%)</th>
<th>DRY DENSITY (PCF)</th>
<th>SYMBOL</th>
<th>CLASSIFICATION U.S.C.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bulk sample.</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Modified split-barrel drive sampler.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No recovery with modified split-barrel drive sampler.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Sample retained by others.</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Standard Penetration Test (SPT).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No recovery with a SPT.</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Shelby tube sample. Distance pushed in inches/length of sample recovered in inches.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No recovery with Shelby tube sampler.</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Continuous Push Sample.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Seepage.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Groundwater encountered during drilling.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Groundwater measured after drilling.</td>
</tr>
</tbody>
</table>

**MAJOR MATERIAL TYPE (SOIL):**
- Solid line denotes unit change.
- Dashed line denotes material change.

Attitudes: Strike/Dip
- b: Bedding
- c: Contact
- j: Joint
- f: Fracture
- F: Fault
- cs: Clay Seam
- s: Shear
- bss: Basal Slide Surface
- sf: Shear Fracture
- sz: Shear Zone
- sbs: Shear Bedding Surface

The total depth line is a solid line that is drawn at the bottom of the boring.

**BORING LOG EXPLANATION SHEET**

Updated Nov. 2011
<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Bulk Driven Blows/Foot</th>
<th>Moisture (%)</th>
<th>Dry Density (PCF)</th>
<th>Symbol</th>
<th>Classification</th>
<th>Classifications/Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>24</td>
<td></td>
<td></td>
<td>CL</td>
<td>FILL:</td>
<td>Brown, moist, very stiff, sandy lean CLAY.</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Stiff.</td>
</tr>
<tr>
<td>10</td>
<td>32</td>
<td></td>
<td></td>
<td>SC</td>
<td>ALLUVIUM:</td>
<td>Brown, moist, medium dense, clayey SAND; scattered caliche nodules.</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Medium dense.</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Total Depth = 10 feet. Groundwater not encountered during drilling. Backfilled on 6/23/16 shortly after completion of drilling. Notes: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.</td>
</tr>
</tbody>
</table>
**DESCRIPTION/INTERPRETATION**

**DATE DRILLED** 6/23/16  **BORING NO.** B-2

**GROUND ELEVATION** 983' (NAVD 88)  **SHEET** 1 OF 1

**METHOD OF DRILLING** CME-75, 8" Diameter Hollow-Stem Auger (D&S Drilling)

**DRIVE WEIGHT** 140 lbs. (Automatic)  **DROP** 30'

**SAMPLED BY** DM  **LOGGED BY** DM  **REVIEWED BY** DT

---

**CL**

FILL:
Brown, dry, stiff, sandy lean CLAY.

---

**SC**

Brown, moist, medium dense, clayey SAND.

---

**SM**

ALLUVIUM:
Brown, moist, medium dense, clayey SAND; trace gravel.

Total Depth = 10 feet.
Groundwater not encountered during drilling.
Backfilled on 6/23/16 shortly after completion of drilling.

Notes:
Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.

The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.
<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>SAMPLES</th>
<th>BLOWS/FOOT</th>
<th>MOISTURE (%)</th>
<th>DRY DENSITY (PCF)</th>
<th>SYMBOL</th>
<th>CLASSIFICATION</th>
<th>U.S.C.S.</th>
<th>DESCRIPTION/INTERPRETATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Bulk</td>
<td>10</td>
<td>8.7</td>
<td>93.6</td>
<td>ML</td>
<td>FILL:</td>
<td></td>
<td>Brown, dry, stiff, sandy SILT.</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Firm.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>SC</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td>ALLUVIUM:</td>
<td></td>
<td>Brown, dry, medium dense, clayey SAND.</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Total Depth = 10 feet.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Groundwater not encountered during drilling.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Backfilled on 6/23/16 shortly after completion of drilling.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**

Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.

The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.
### BORING LOG

**91ST AVENUE WASTEWATER TREATMENT PLANT SLUDGE SOLAR DRYING BEDS**  
**PHOENIX, ARIZONA**

<table>
<thead>
<tr>
<th>DEPTH (feet)</th>
<th>BLOWS/FOOT</th>
<th>MOISTURE (%)</th>
<th>DRY DENSITY (PCF)</th>
<th>SYMBOL</th>
<th>CLASSIFICATION</th>
<th>U.S.C.S.</th>
<th>DESCRIPTION/INTERPRETATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td>SC</td>
<td>ALLUVIUM:</td>
<td>Brown, dry, dense, clayey SAND.</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td></td>
<td></td>
<td></td>
<td>SC</td>
<td></td>
<td></td>
<td>No recovery - possible coarse gravel; possible cobbles.</td>
</tr>
<tr>
<td>44</td>
<td></td>
<td></td>
<td></td>
<td>SC</td>
<td></td>
<td></td>
<td>Moist; loose.</td>
</tr>
<tr>
<td>27</td>
<td></td>
<td></td>
<td></td>
<td>SM</td>
<td>Brown, dry, loose, silty SAND.</td>
<td></td>
<td>@13': Groundwater measured after completion of drilling.</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td>SP</td>
<td>Brown, wet, very loose, poorly graded SAND;</td>
<td></td>
<td>Brown, wet, very loose, clayey SAND; few gravel.</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td>SC</td>
<td></td>
<td></td>
<td>Brown, saturated; medium dense, clayey SAND; few gravel.</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td>SC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td>SC</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**DATE DRILLED** 6/23/16  
**BORING NO.** B-4  
**GROUND ELEVATION** 984' (NAVD 88)  
**METHOD OF DRILLING** CME-75, 8" Diameter Hollow-Stem Auger (D&S Drilling)  
**DRIVE WEIGHT** 140 lbs. (Automatic)  
**DROP** 30"  
**SAMPLED BY** DM  
**LOGGED BY** DM  
**REVIEWED BY** DT
Total Depth = 20 feet.
Groundwater was measured at a depth of approximately 13 feet in borehole after completion of drilling on 6/23/16.
Backfilled on 6/23/16 shortly after completion of drilling.

Notes:
Groundwater may rise to a level higher than that measured in borehole due to seasonal variations in precipitation and several other factors as discussed in the report.

The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.
<table>
<thead>
<tr>
<th>DEPTH (feet)</th>
<th>SAMPLING</th>
<th>BLOWS/FOOT</th>
<th>MOISTURE (%)</th>
<th>DRY DENSITY (PCF)</th>
<th>SYMBOl</th>
<th>CLASSIFICATION U.S.C.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>SC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>FILL: Brown, dry, dense, clayey SAND; few gravel.</td>
</tr>
<tr>
<td>5</td>
<td>SC</td>
<td>53</td>
<td></td>
<td></td>
<td></td>
<td>No gravel.</td>
</tr>
<tr>
<td>8</td>
<td>SM</td>
<td>62</td>
<td></td>
<td></td>
<td></td>
<td>ALLUVIUM: Brown, dry, dense, clayey SAND.</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td>Brown, dry, medium dense, silty SAND.</td>
</tr>
</tbody>
</table>

Total Depth = 10 feet.
Groundwater not encountered during drilling.
Backfilled on 6/23/16 shortly after completion of drilling.

Notes:
Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.

The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.
ALLUVIUM:
Brown, dry, medium dense, clayey SAND.

Total Depth = 10 feet.
Groundwater not encountered during drilling.
Backfilled on 6/23/16 shortly after completion of drilling.

Notes:
Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.

The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.
## BORING LOG

**91ST AVENUE WASTEWATER TREATMENT PLANT SLUDGE SOLAR DRYING BEDS**  
**PHOENIX, ARIZONA**

<table>
<thead>
<tr>
<th>DEPTH (feet)</th>
<th>SAMPLE</th>
<th>BLOWS/FOOT</th>
<th>MOISTURE (%)</th>
<th>DRY DENSITY (PCF)</th>
<th>SYMBOL</th>
<th>CLASSIFICATION</th>
<th>U.S.C.S.</th>
<th>DESCRIPTION/INTERPRETATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>54</td>
<td>6.3</td>
<td>109.4</td>
<td>CL</td>
<td>ALLUVIUM:</td>
<td></td>
<td>Brown, dry, hard, sandy lean CLAY; few to little gravel; cobbles.</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>34</td>
<td></td>
<td></td>
<td>SM</td>
<td></td>
<td></td>
<td>Brown, dry, medium dense, silty SAND; trace coarse gravel.</td>
</tr>
</tbody>
</table>

**DATE DRILLED:** 6/23/16  
**BORING NO.:** B-7  
**GROUND ELEVATION:** 983' ± (NAVD 88)  
**METHOD OF DRILLING:** CME-75, 8" Diameter Hollow-Stem Auger (D&S Drilling)  
**DRIVE WEIGHT:** 140 lbs. (Automatic)  
**DROP:** 30'  
**GROUND ELEVATION:** 983' ± (NAVD 88)  
**METHOD OF DRILLING:** CME-75, 8" Diameter Hollow-Stem Auger (D&S Drilling)  
**DATE DRILLED:** 6/23/16  
**BORING NO.:** B-7  
**GROUND ELEVATION:** 983' ± (NAVD 88)  
**METHOD OF DRILLING:** CME-75, 8" Diameter Hollow-Stem Auger (D&S Drilling)  
**DRIVE WEIGHT:** 140 lbs. (Automatic)  
**DROP:** 30'  
**SAMPLED BY:** DM  
**LOGGED BY:** DM  
**REVIEWED BY:** DT

**Notes:**  
Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.  

The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.
APPENDIX B

LABORATORY TESTING

Classification
Soils were visually and texturally classified in accordance with the Unified Soil Classification System (USCS) in general accordance with ASTM D 2488. Soil classifications are indicated on the logs of the exploratory borings in Appendix A.

In-Place Moisture and Density Tests
The moisture content and dry density of relatively undisturbed samples obtained from the exploratory borings were evaluated in general accordance with ASTM D 2937. The test results are presented on the logs of the exploratory borings in Appendix A.

Gradation Analysis
Gradation analyses tests were performed on selected representative soil samples in general accordance with ASTM D 422. The grain-size distribution curves are shown on Figures B-1 through B-5. These test results were utilized in evaluating the soil classifications in accordance with the USCS.

Atterberg Limits
Tests were performed on selected representative fine-grained soil samples to evaluate the liquid limit, plastic limit, and plasticity index in general accordance with ASTM D 4318. These test results were utilized to evaluate the soil classification in accordance with the USCS. The test results and classifications are shown on Figure B-6.

Consolidation Test
A consolidation test was performed on a selected relatively undisturbed soil sample in general accordance with ASTM D 2435. The sample was inundated during testing to represent adverse field conditions. The percent of consolidation for each load cycle was recorded as a ratio of the amount of vertical compression to the original height of the sample. The results of the test are summarized on Figure B-7, B-8, and B-9.

Soil Corrosivity Tests
Soil pH and minimum resistivity tests were performed on a representative soil sample in general accordance with Arizona Test 236c. The sulfate content was evaluated in general accordance with Arizona Test 733. The chloride content was evaluated in general accordance with Arizona Test 736. The test results are presented on Figure B-10.
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422
### GRADEATION TEST RESULTS

**PROJECT NO.**
605022001  
**DATE**
8/16  
**ADDRESS**
91ST AVENUE WWTP SLUDGE SOLAR DRYING BEDS  
WS 90100098  
TOLLESON, ARIZONA  
**FIGURE**
B-3

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Hole No.</th>
<th>Depth (ft)</th>
<th>Liquid Limit</th>
<th>Plastic Limit</th>
<th>Plasticity Index</th>
<th>D_{10}</th>
<th>D_{30}</th>
<th>D_{60}</th>
<th>C_{c}</th>
<th>C_{u}</th>
<th>Passing No. 200 (%)</th>
<th>U.S.C.S</th>
</tr>
</thead>
<tbody>
<tr>
<td>● B-3</td>
<td>0.0-5.0</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>NP</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>65</td>
<td>ML</td>
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PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422
<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>LOCATION</th>
<th>DEPTH (FT)</th>
<th>LIQUID LIMIT, LL</th>
<th>PLASTIC LIMIT, PL</th>
<th>PLASTICITY INDEX, PI</th>
<th>USCS CLASSIFICATION (Fraction Finer Than No. 40 Sieve)</th>
<th>USCS (Entire Sample)</th>
</tr>
</thead>
<tbody>
<tr>
<td>•</td>
<td>B-1</td>
<td>0.0-5.0</td>
<td>32</td>
<td>14</td>
<td>18</td>
<td>CL</td>
<td>CL</td>
</tr>
<tr>
<td>■</td>
<td>B-3</td>
<td>1.0-2.5</td>
<td>28</td>
<td>19</td>
<td>9</td>
<td>CL</td>
<td>CL</td>
</tr>
<tr>
<td>◆</td>
<td>B-3</td>
<td>0.0-5.0</td>
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<td>--</td>
<td>NP</td>
<td>ML</td>
<td>ML</td>
</tr>
<tr>
<td>○</td>
<td>B-4</td>
<td>1.0-2.5</td>
<td>27</td>
<td>16</td>
<td>11</td>
<td>CL</td>
<td>SC</td>
</tr>
<tr>
<td>□</td>
<td>B-7</td>
<td>1.0-2.5</td>
<td>27</td>
<td>14</td>
<td>13</td>
<td>CL</td>
<td>CL</td>
</tr>
</tbody>
</table>

NP - INDICATES NON-PLASTIC

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4318
Seating Cycle Sample Location B-1
Loading Prior to Inundation Depth (ft.) 1.0-2.5
Loading After Inundation Soil Type SC
Rebound Cycle

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435

CONSOLIDATION TEST RESULTS

<table>
<thead>
<tr>
<th>PROJECT NO.</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>605022001</td>
<td>8/16</td>
</tr>
</tbody>
</table>
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435
CONSOLIDATION TEST RESULTS

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435

STRESS IN KIPS PER SQUARE FOOT

EXPANSION (%)

CONSOLIDATION IN PERCENT OF SAMPLE THICKNESS (%)

STRESS IN KIPS PER SQUARE FOOT

CONSOLIDATION TEST RESULTS

PROJECT NO. | DATE
--- | ---
605022001 | 8/16
<table>
<thead>
<tr>
<th>SAMPLE LOCATION</th>
<th>SAMPLE DEPTH (FT)</th>
<th>pH (^1)</th>
<th>RESISTIVITY (^1) (Ohm-cm)</th>
<th>SULFATE CONTENT (^2) (ppm)</th>
<th>CHLORIDE CONTENT (^3) (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-1</td>
<td>0.0-5.0</td>
<td>8.1</td>
<td>440</td>
<td>779</td>
<td>0.078</td>
</tr>
<tr>
<td>B-6</td>
<td>0.0-5.0</td>
<td>8.0</td>
<td>570</td>
<td>1198</td>
<td>0.120</td>
</tr>
</tbody>
</table>

\(^1\) PERFORMED IN GENERAL ACCORDANCE WITH ARIZONA TEST METHOD 236c
\(^2\) PERFORMED IN GENERAL ACCORDANCE WITH ARIZONA TEST METHOD 733
\(^3\) PERFORMED IN GENERAL ACCORDANCE WITH ARIZONA TEST METHOD 736
Mr. Chris Simko, PE  
Stantec  
8211 South 48th Street  
Phoenix, Arizona 85044

Subject: Addendum 1 to Geotechnical Evaluation dated August 5, 2016  
91st Avenue Wastewater Treatment Plant  
Sludge Solar Drying Beds - WS 9010098  
Phoenix, Arizona

Dear Mr. Simko:

As requested by Ms. Leila Sermek, we are providing revised pavement recommendations, based on new traffic data provided by your office for two sections. The two sections consist of one section for the access roads and ramps, and one section for the drying beds to be located at the subject site. Based on the new traffic data provided and summarized below, the calculated asphalt pavement sections for the access roads and ramps, and the drying beds are provided in this addendum to the Geotechnical Report dated August 5, 2016. The design parameters for these pavement sections should include a 20-year design life and an equivalent single axle loading (ESAL) of 18 kips:

<table>
<thead>
<tr>
<th>Pavement for Access Roads and Ramps</th>
<th>Pavement for Drying Beds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Truck GVWR</td>
<td>40 ton</td>
</tr>
<tr>
<td>Truck Capacity</td>
<td>25 ton</td>
</tr>
<tr>
<td>Average annual number of trucks per day</td>
<td>40</td>
</tr>
<tr>
<td>Number of axles</td>
<td>4</td>
</tr>
<tr>
<td>Growth Factor</td>
<td>0% to 4%</td>
</tr>
<tr>
<td>Calculated ESAL’s</td>
<td>228,000 to 315,000</td>
</tr>
<tr>
<td>Calculated Design Structural Number (SN)</td>
<td>2.7 to 2.8</td>
</tr>
</tbody>
</table>
For access roads and ramps, we are in agreement with the City Lab and recommend an asphalt pavement section consisting of 7.5 inches or more of asphalt concrete (AC) over 6 inches scarified and compacted subgrade by appropriate mechanical methods to a relative compaction of 100 percent, as evaluated by ASTM D 698 at a moisture content generally near its optimum.

For drying beds, we recommend an asphalt pavement section consisting of 5 inches or more of AC over 6 inches scarified and compacted subgrade by appropriate mechanical methods to a relative compaction of 100 percent, as evaluated by ASTM D 698 at a moisture content generally near its optimum. Pavement maintenance may be required at early stage for drying beds.

Please note the 6 inches scarification is in addition to the remedial grading recommendations provided in the Geotechnical Evaluation report due to the loose soils encountered in our boring in some locations. The remedial measures consisted of 12 inches of moisture-conditioned and compacted engineered fill measured from the bottom of the base material and compacted by appropriate mechanical methods to 95 percent relative compaction, as evaluated by ASTM D 698 at moisture content generally near its optimum. This improved zone should extend below the 6 inch scarified compacted subgrade described above in the absence of base material. The remedial grading below these areas should extend laterally 1 foot or more horizontally beyond the slab/pavement footprint. This improved zone was recommended to be either improved by overexcavation or scarification. For the revised pavement sections, scarification of the improved zone may be more suitable for construction of the 6 inch scarified subgrade treatment, for a total depth of scarification of 18 inches or more measured below the asphalt pavement section into the existing materials. The total depth of scarification should be compacted by appropriate mechanical methods to a relative compaction of 100 percent, as evaluated by ASTM D 698 at moisture content generally near its optimum.

Following scarification the resulting exposed surface should be carefully evaluated by Ninyo & Moore for the presence of soft, loose, or wet soils. Based on this evaluation, additional remediation may be needed. This could include further scarification of the exposed surface. Additional remediation, if needed, should be addressed by the geotechnical consultant during the earthwork operations. Subgrade materials below new pavement should not have an R-value less
than 17, or include organic material, construction debris, or other non-soil fill materials. Rock particles and clay lumps should not be larger than 4 inches in dimension.

Additional recommendations for the design and construction of this project were provided in the Geotechnical Evaluation report dated August 5, 2016.

We appreciate the opportunity to be of service to you during this phase of the project.

Respectfully submitted,

NINYO & MOORE

[Signature]

Kenneth Rush, III, PE
Senior Project Engineer

Don Tharp, PE
Principal Engineer

Distribution: (1) Address (via email)