CONTRACT SET

PROJECT SPECIFICATIONS AND CONTRACT DOCUMENTS

C-7708
06/14/2011

PROJECT 091033

ARROWHEAD UV UPGRADE
PROCUREMENT DOCUMENTS FOR NEW DISINFECTION SYSTEM

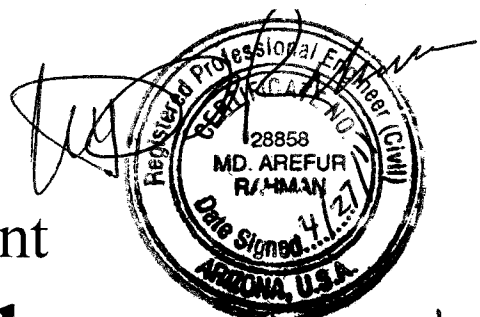
APRIL 2011

GLENDALE

REGISTERED PROFESSIONAL ENGINEER (CIVIL)
CERTIFICATE NO.
50592
ANDREW J.
MALLY
Date Signed 4/1/11
ARIZONA, U.S.A.
Expires 3/31/2013

CITY OF GLENDALE

ENGINEERING DEPARTMENT
5850 W. Glendale Avenue, Glendale, Arizona 85301 (623) 930-3630



GLENDALE

Engineering Department

Memorandum

EXPIRES ON 3/31/13

DATE: April 27, 2011
TO: All Plan and Specification Holders
FROM: Engineering
SUBJECT: PROJECT NO. 091033 – ARROWHEAD UV UPGRADE PROCUREMENT DOCUMENTS FOR NEW DISINFECTION SYSTEM

ADDENDUM NO. 4

In accordance with the contract documents "Information for Bidders," Page 6, Paragraph 12 CHANGES TO PLANS AND DOCUMENTS, the following revisions to the plans and specifications shall become a part of the contract documents and the bidder shall acknowledge receipt thereof as directed in Paragraph 13 of the Information for Bidders.

Addendum Items

1. **Information for Bidders:**
   Item 9, Insurance requirements, shall be replaced to match the new Insurance Requirements identified in Item 3 below.

2. **Construction Agreement:**
   Delete Item 3.7 Bonds.

3. **Construction Agreement:**
   Replace Item 7 Insurance (Pages 22-24) with the attached Revised Insurance requirements.

4. **Statutory Performance and Payment Bonds** (Page 34 and 35)**:**
   Performance and Payment bonds will not be required for this contract. Delete Pages 34 and 35.

5. **Special Provisions, Item 3, Definitions:**
   Add the following definition:
   SUBCONTRACTOR – Any person, firm or corporation that the Contractor contracts with to perform on-site work or provide on-site services for this project at the Arrowhead Water Reclamation Facility Site.

Attachment 1 – Revised Insurance Requirements

INSURANCE REQUIREMENTS:
Contractor and subcontractors shall procure and maintain until all of their obligations have been discharged, including any warranty periods under this Contract are satisfied, insurance against claims for injury to persons or damage to property which may arise from or in connection with the performance of the work hereunder by the Contractor, his agents, representatives, employees or subcontractors.

The insurance requirements herein 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 contained herein are sufficient to protect the Contractor from liabilities that might arise out of the performance of the work under this Contract by the Contractor, his agents, representatives, employees or subcontractors and Contractor is free to purchase such additional insurance as may be determined necessary.

MINIMUM SCOPE AND LIMITS OF INSURANCE: Contractor shall provide coverage with limits of liability not less than those stated below.

1. Commercial General Liability – Occurrence Form

Policy shall include bodily injury, property damage, and broad form contractual liability coverage.

General Aggregate	$2,000,000
Products – Completed Operations Aggregate	$2,000,000
Personal and Advertising Injury	$1,000,000
Combined Single Limit (CSL) per occurrence	$1,000,000

The policy shall be endorsed to include the following additional insured language: "The City of Glendale shall be named as an additional insured with respect to liability arising out of the activities performed by, or on behalf of the Contractor".

2. Automobile Liability

Bodily Injury and Property Damage for any owned, hired, and non-owned vehicles used in the performance of this Contract.

Combined Single Limit (CSL) per accident	$1,000,000

The policy shall be endorsed to include the following additional insured language: "The City of Glendale shall be 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

Policy shall contain a waiver of subrogation against the City of Glendale.

ADDITIONAL INSURANCE REQUIREMENTS: The policies are to contain, or be endorsed to contain, the following provisions:

1. On insurance policies where the City of Glendale is named as an additional insured, the City of Glendale shall be 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 shall be primary insurance and non-contributory with respect to all other available sources.

3. Coverage provided by the Contractor shall not be limited to the liability assumed under the indemnification provisions of this Contract.

NOTICE OF CANCELLATION: Each insurance policy required by the insurance provisions of this Contract shall provide the required coverage and shall not be suspended, voided, canceled, reduced in coverage or endorsed to lower limits except after thirty (30) days prior written notice has been given to the City. Such notice shall be sent directly to City of Glendale Risk Management Department at 5850 W. Glendale Ave., Glendale, AZ 85301 and shall be sent by certified mail, return receipt requested.

ACCEPTABILITY OF INSURERS: Insurance is to be placed with insurers duly licensed or approved unlicensed companies in the State of Arizona and with an "A.M. Best" rating of not less than "A-". The City in no way warrants that the above-required minimum insurer rating is sufficient to protect the Contractor from potential insurer insolvency.

VERIFICATION OF COVERAGE: Within 10 business days after the execution of the Agreement, Contractor shall 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.

All certificates and 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 shall be sent directly to City of Glendale Department Risk Management division at 5850 W. Glendale Ave., Glendale, AZ 85301. The City reserves the right to require complete, certified copies of all insurance policies required by this Contract at any time.

SUBCONTRACTORS: Contractors' certificate(s) shall include all subcontractors as additional insureds under its policies or Contractor shall furnish to the City separate certificates and endorsements for each subcontractor. All coverages for subcontractors shall be subject to the minimum requirements identified above.

APPROVAL: Any modification or variation from the insurance requirements in this Contract must have prior approval from the City of Glendale Legal Department, whose decision shall be final. Such action will not require a formal contract amendment, but may be made by administrative action.

INDEMNIFICATION:
Contractor shall indemnify, defend, save and hold harmless the City of Glendale and its officers, officials, agents, and employees (hereinafter referred to as "Indemnitee") from and against any and all claims, actions, liabilities, damages, losses, or expenses (including court costs, attorneys' fees, and costs of claim processing, investigation and litigation) (hereinafter referred to as "Claims") for bodily injury or personal injury (including death), or loss or damage to tangible or intangible property caused, or alleged to be caused, in whole or in part, by the negligent or willful acts or omissions of Contractor or any of its owners, officers, directors, agents, employees or subcontractors. This indemnity includes any claim or amount arising out of or recovered under the

Workers' Compensation Law or arising out of the failure of such Contractor to conform to any federal, state or local law, statute, ordinance, rule, regulation or court decree. It is the specific intention of the parties that the Indemnitee shall, in all instances, except for Claims arising solely from the negligent or willful acts or omissions of the Indemnitee, be indemnified by Contractor from and against any and all claims. It is agreed that Contractor will be responsible for primary loss investigation, defense and judgment costs where this indemnification is applicable. In consideration of the award of this contract, the Contractor agrees to waive all rights of subrogation against the City, its officers, officials, agents and employees for losses arising from the work performed by the Contractor for the City.

WAIVER OF SUBROGATION

Contractor waives and will require any subcontractor to waive, all rights of subrogation against the City to the extent of all losses or damages covered by any policy of insurance.

END OF ADDENDUM

GLENDALE

Engineering Department

Memorandum

DATE: April 22, 2011
TO: All Plan and Specification Holders
FROM: Engineering
SUBJECT: PROJECT NO. 091033 – ARROWHEAD UV UPGRADE PROCUREMENT DOCUMENTS FOR NEW DISINFECTION SYSTEM

Registered Professional Engineer (Civil)
CERTIFICATE NO.
28858
MD. AREFUR RAHMAN
Date Signed 4/22/11
ARIZONA, U.S.A.

EXPIRES 3/31/13

ADDENDUM NO. 3

In accordance with the contract documents "Information for Bidders," Page 6, Paragraph 12 CHANGES TO PLANS AND DOCUMENTS, the following revisions to the plans and specifications shall become a part of the contract documents and the bidder shall acknowledge receipt thereof as directed in Paragraph 13 of the Information for Bidders.

1. **Revision to Addendum No. 2:**
   The bid date has been extended by one additional week. Please revise the Notice to Bidders to read as follows: "Bids must be received by the Engineering Department of the City of Glendale no later than 2:00p.m., Tuesday, May 3rd, 2011.

2. **INFORMATION FOR BIDDERS, Item 10. Subcontractor Listing and Certification of Contract Compliance, Page 6:**
   Add the following: If the Bidder will not have any subcontractors, list "NONE" in the Form in Page 18 and Fill in information requested at the bottom of the page including Signature.

3. **Construction Agreement, Exhibit D:**
   Delete Items 1.2 and 1.3.

4. **Certificate of Insurance, Pages 36 and 37**:
   The Insurance Form provided is provided as a template/example, the use of this form is not a requirement. An ACORD form can be substituted for the example shown, provided that the insurance requirements set forth in the Contract Documents are adhered to.

5. **Special Provisions, Item 6, Protection of Finished or partially finished work:**
   Replace the paragraph "The Contractor shall.. final settlement shall be made" with "NOT APPLICABLE".

6. **Special Provisions, Item 8. Laws and Regulations 43:**

Replace the first sentence with, "This contract shall be governed by the laws of the State of Arizona".

7. **Special Provisions, Item 16. Cash Flow Report, Pages 44:**
   Delete the second line, "The accumulation of….. schedule".

8. **Technical Specifications:**
   All uses of the word "Contractor" contained in the Division 1 through Division 16 specification sections shall be replaced with the words "Construction Contractor".

9. **Specification 13700P – Ultraviolet Disinfection System General Requirements, Section 1-2.02, 4th Paragraph**
   After the sentence that reads, "The UVSS Power Panel will be supplied with one 480 volt, 3 phase, 4 wire, 60 Hz circuit from the existing plant." Add the following statement, "The UVSS Power Panel shall have a minimum Short Circuit Interrupting Rating of 25kAIC."

Clarifications

The following clarifications are intended for clarification of contract language:

1. **Should the UV bid include taxes?** *Each bid shall be provided with all applicable, federal, state, local and other taxes included.*

2. **Is the UVSS responsible for supplying and wiring the power panel?** *Specification 13700P, Section 1-2.02, 4th Paragraph states the following "The UVSS shall be responsible for providing a dedicated Power Panel for power service to the UV system equipment. All circuits necessary to support the UV system shall be derived from this Power Panel. The Power Panel will be installed by the Contractor with direction from the UVSS, Engineer and as shown on the drawings. The UVSS Power Panel will be supplied with one 480 volt, 3 phase, 4 wire, 60 Hz circuit from the existing plant. All necessary transformation equipment to convert this voltage to utilization voltages shall be provided by the UVSS and installed by the Contractor if required. Any additional electrical distribution equipment necessary to support the UV system shall be provided by the UVSS and installed by the Contractor. Coordination with the Contractor and Engineer is necessary and expected." Deviations are not acceptable.*

3. **What is the purpose of including A/C costs in the bid?** *The ARWRF UV Upgrade is funded by the Department of Energy. As such, this project is heavily focused on energy usage and potential savings with the replacement UV system. As air conditioning can account for substantial energy use, we feel it must be considered as heavily as the energy requirements for operating the UV equipment.*

4. **Information for Bidders, Page 7, Item 17:** *The privilege tax refers to sales tax.*

END OF ADDENDUM

GLENDALE

Engineering Department

Memorandum

DATE: April 15, 2011
TO: All Plan and Specification Holders
FROM: Engineering
SUBJECT: PROJECT NO. 091033 – ARROWHEAD UV UPGRADE PROCUREMENT DOCUMENTS FOR NEW DISINFECTION SYSTEM

ADDENDUM NO. 2

In accordance with the contract documents "Information for Bidders," Page 6, Paragraph 12 CHANGES TO PLANS AND DOCUMENTS, the following revisions to the plans and specifications shall become a part of the contract documents and the bidder shall acknowledge receipt thereof as directed in Paragraph 13 of the Information for Bidders.

1. The Bid Date has been extended by one week. Please revise the Notice to Bidders to read as follows:

"Bids must be received by the Engineering Department of the City of Glendale no later than 2:00 p.m., April 26, 2011."

Registered Professional Engineer (Civil)
CERTIFICATE NO.
28858
MD. AREFUR RAHMAN
Date Signed 4/15
ARIZONA, U.S.A.

EXPIRES 3/31/13

END OF ADDENDUM

GLENDALE AZ

Engineering Department

Memorandum

DATE: April 13, 2011
TO: All Plan and Specification Holders
FROM: Engineering
SUBJECT: PROJECT NO. 091033 – ARROWHEAD UV UPGRADE PROCUREMENT DOCUMENTS FOR NEW DISINFECTION SYSTEM

ADDENDUM NO. 1

In accordance with the contract documents "Information for Bidders," Page 6, Paragraph 12 CHANGES TO PLANS AND DOCUMENTS, the following revisions to the plans and specifications shall become a part of the contract documents and the bidder shall acknowledge receipt thereof as directed in Paragraph 13 of the Information for Bidders.

PLEASE SEE ATTACHED

Expires 3/31/2013

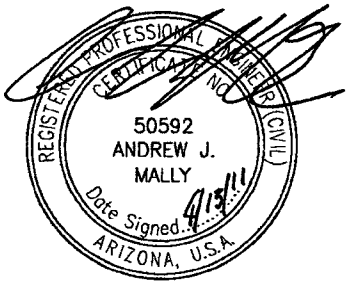
GLENDALE

ADDENDUM NO. 1

TO THE NEW UV SYSTEM PROCUREMENT DOCUMENTS FOR THE ARROWHEAD RANCH WATER RECLAMATION FACILITY UV UPGRADE

CITY PROJECT NO. 091033

April 13, 2011



Expires 3/31/2013

To: All Document Holders

The following changes, additions, and/or deletions are hereby made a part of the document package to furnish, deliver, and provide special services for the **ARROWHEAD UV UPGRADE – PROCUREMENT DOCUMENTS FOR NEW UV DISINFECTION SYSTEM** as fully and completely as if the same were fully set forth therein:

Addendum Items

1. **Bid Form – Item 3f**

   Item 3f in Page 15 of the Bid Form shall have a revised equation as (24*3d*3e/1000) Kw.hr. Page 15 of the bid form is revised and reissued as attachment.

2. **Specification 13700P – Ultraviolet Disinfection System General Requirements, Section 1-6, 2nd Paragraph**

   Replace the first sentence of the paragraph with the following: "Lamps shall be warranted for a guaranteed life (i.e. 12,000 hrs) and shall be capable of producing the validated dose (as specified) for the entirety of that lamp life."

3. **Specification 13700P – Ultraviolet Disinfection System General Requirements, Section 2-2.01**

Inlet bacterial count shall be revised from reading ">1600" to read "Analytical Maximum"

4. **Specification 13700P – Ultraviolet Disinfection System General Requirements, Section 2-3.01.05.01**

Revise the last sentence to read "Transformers shall be K-rated if required by the UVSS to meet harmonic requirements."

5. **Specification 13702P – Low Pressure High Output UV Reactors – Alternative B, Section 2-4.01, Last Paragraph, Page 7**

Revise the statement "as required by the equipment supplied" with the statement "if required by the equipment supplied."

6. **Specification 13704P – Ultraviolet Disinfection System Performance Testing, Section 1.3.1, 3rd Paragraph, 2nd Sentence**

Remove the phrase "the delivery of the UV dosage."

7. **Specification 13704P – Ultraviolet Disinfection System Performance Testing, Section 1.3.3.2, Page 5**

Revise the sentence that reads "The UVSS will pay for testing at 2,000, 4,000, 6,000, and 8,760 hours" with the sentence "The UVSS will pay for testing at 1,000, 2,000, 3,000, and 4,380 hours."

8. **Specification 13704P – Ultraviolet Disinfection System Performance Testing, Section 1.3.3.1, Paragraph 9, Page 5**

Revise the paragraph that reads "The performance tests shall be under the direct supervision of Vic Moreland Consulting or other qualified UVSS field representative. The UVSS representative shall have previous satisfactory experience in conducting tests of the type specified. All costs for subsequent trips by Vic Moreland and/or the UVSS's field representative for the purpose of modifying and retesting the UV equipment shall be solely at the expense of the UVSS, provided the retests are required due to the function of the UV system." to state "The performance tests shall be under the direct supervision of Vic Moreland Consulting or other qualified representative. Services shall be procured through the Construction Contractor or other City delegate and shall be at their expense for the initial testing. The representative shall have previous satisfactory experience in conducting tests of the type specified. All costs for subsequent trips by Vic Moreland and/or the UVSS's field representative for the purpose of modifying and retesting the UV equipment shall be solely at the expense of the UVSS, provided the retests are required due to the function of the UV system.

Clarifications

The following clarifications are intended to respond to questions submitted by prospective bidders. The responses to these questions **DO NOT** amend the contract documents.

1. Is the tertiary filtration a media or membrane type? ***Tertiary filtration is accomplished using Dynasand filtration technology.***

2. Section 13700P lists the maximum fouling factor for Bid Alternative C (Ozonia) as 0.75. Per the NWRI guidelines and as recommended by the California Department of Public Health, UV systems that have not tested and validated a fouling factor shall use a maximum fouling factor of 0.80. Please confirm that Ozonia can utilize a maximum fouling factor of 0.80 as recommended by both the NWRI guidelines and California Department of Public Health (CADPH). ***All manufacturers have had fouling factors derated due to historical performance issues with the plant filters. Project shall be bid as specified.***

3. Please confirm if in-channel redundancy (example: full redundant bank) is required at the peak flow while meeting the minimum dose conditions. This is typically recommended and required for reuse applications. ***No in-channel redundancy is required for this project.***

4. 13530, 2-1.03 - We request the spare I/O capacity indicated be reduced or removed as we are providing a standardized package design with no expected requirements to put in additional I/O. ***Spare I/O shall be provided as specified.***

5. 13530, 2-5.01 - We would like to request the option of a 24 V operator interface. ***Provide 120 volt operator interface as specified.***

6. 13530, 2-5.04 - We request the option for a 24 V UPS with 24 V controls. Please also allow Phoenix Contact as an acceptable manufacturer for the UPS. ***Provide 120 volt UPS and 120 volt controls as specified. See "Or Equal" clause in Front End Documents for requirements to request equal products.***

7. 13700P, 1-1 - Please clarify if the use of the inlet gates is for flow control or just simple channel isolation. Typically inlet gates are provided for channel isolation only. ***Inlet gates are for isolation only.***

8. 13700P, 1-1.02.1 - Please clarify if the use of the inlet gates is for flow control or just simple channel isolation. Typically inlet gates are provided for channel isolation only. ***Inlet gates are for isolation only.***

9. 13700P, 1-2 - As it is unclear, please clarify the scope and responsibility for the PLC and PCS integration as far as what the UVSS is responsible for versus the contractor.

Refer to the referenced section, paragraph 5 for details on integration responsibility. As specified, "The UVSS shall be responsible for the integration of the PLC and OIT equipment provided by the UVSS and required for UV operation. The UVSS shall coordinate signal interchange requirements between the PLC and the Plant Control System (PCS) such that the PCS will be capable of monitoring all parameters within the PLC requested by the Owner. Integration of the PCS will be done by Others."

10. 13700P, 1-4.01.d - Regarding the owner's tag numbering system, it is important to note that we have a standardized, well documented tag system and would request our standard be allowed. ***Tagging shall be per the City's standard tagging system. Other tagging systems are not acceptable.***

11. 13700P, 1-4.02.c - Remove last sentence in this item as the system is going in a climate-controlled building and will not see this high of temperatures. ***It is understood that the system will be installed in a climate controlled building. However, the design requirement shall be followed as specified.***

12. 13700P, 2-2.01 - Please note that the 95% lamp life factor indicated for Alternative A is not a realistic number. Consider capping to 90% or lower as no lamp manufacturer will guarantee higher than 90%. ***EOLL and FF values shall remain as specified.***

13. 13700P, 2-2.01 - Please revise the fouling factor for Alternative B to 90% which has been accepted by California on operating and permitted sites. ***All manufacturers have had fouling factors derated due to historical performance issues with the plant filters. Project shall be bid as specified.***

14. 13700P, 2-2.01 - As a general comment on the factors, please keep in mind that the lamp life and fouling factors as stated are design factors and not safety factors. The numbers presented as indicated would result in 11%+ less equipment comparing Alternative A versus Alternatives B & C. ***Noted. EOLL and FF values are based on data available from California DPH and have been derated as previously described.***

15. 13700P, 2-2 Previous there was a paragraph indicating that redundancy (standby bank per channel) is required. As this has been removed, please confirm that no redundancy is required. ***Redundancy was removed from the referenced paragraph deliberately and is not required for the purposes of this project. Project shall be bid as specified.***

16. 13700P, 3.01.05.02 (paragraph above 3.01.06) - It is stated that power panel busses shall have 3 phase buses. Please confirm what is meant by this – was this meant to be bus bars? ***Buses/Bus Bars is correct.***

17. 13700P, 2-3.01.07.02 - Please confirm the inlet gates are providing a channel isolation function only and not level control. ***Confirmed. Gates shall be "full open" or "full close" as specified.***

18. 13700P, 2-3.01.07.04 - Note that our preference would be to have a calibrated flow meter if possible immediately prior to the UV system to improve flow measurement accuracy (especially critical for spot-check bioassay). ***Noted. However, a flow signal will not be available.***

19. 13700P, 2-3.01.07.07.b - Please remove reference to the ground fault interrupt. ***Reference shall remain as specified.***

20. 13704P, 1.3.3 - On the top of page 3, note that typically the spot-check bioassay is conducted on one train only. ***Noted. However, this project will require testing on both channels as specified.***

21. 13704P, 1.3.3.1 - On the 2nd line, please remove the "with automatic wiper system" stated as we clean by hand as part of the test. ***It is anticipated that automatic wiper system will be operated as a first clean before the lamps are removed from the channel and hand wiped before the start of the spot check testing.***

22. 13704P, 1.3.3.1 - On page 5, 2nd paragraph, please provide clarification on the details of the performance penalties. ***Clarification: as Each vendor is required to submit energy requirements (with accompanying data) as part of the proposal. Each vendor will be held to these energy requirements as they will be measured during the spot check bioassay testing following installation and construction. If a vendor fails to meet the submitted energy requirements, they will be allowed to make modifications and retest to show that energy requirements can be achieved. If after t he second re-test the vendor fails to achieve the submitted energy requirements, the City has the option of imposing a penalty that is function of the additional power requirements, a future cost of electricity and additional staff time to maintain the system. If a penalty is imposed it is anticipated that it would be around $500/0.1 kwh in excess of the energy requirements established in the proposal. Performance penalties are further addressed in section 1-3.03.02a-d.***

23. 13702P, 2-1.02 - Remove reference to the system being able to be completely submerged. ***Statement will remain as specified.***

24. With regards to the 30 day confirmation testing, how many influent/effluent samples are required per day? Please clarify. ***It is the intent of the 30 day testing that at a minimum one influent and effluent analysis (influent/effluent samples collected at the same time) is performed each day. The UVSS is responsible for determining if additional samples are required to show compliance with the discharge requirements.***

25. "Is the UVSS required onsite everyday for the 30 day confirmation testing, or can the UVSS spend 7 days to train the contractor on sample collection and testing and then have the contractor operate and collect samples for the remaining days? The UVSS would still pay the laboratory costs in this example too."

Specification 13704 indicates the following:

"1) Samples shall be collected by the Contractor under supervision of the UVSS daily during the test period."

"2) The performance tests shall be under the direct supervision of the UVSS. The UVSS's representative shall have previous satisfactory experience in conducting tests of the type specified. All costs for subsequent trips by the UVSS's field representative for the purpose of modifying and retesting the UV equipment shall be solely at the expense of the UVSS, provided the retests are required due to the function of the UV system."

In general the...

1) UVSS must provide supervision for the collection of the samples.
2) Construction Contractor is to collect the samples.

The UVSS is not required to be on-site for the collection of samples during the 30 day period, however needs to be on site sufficient time to provide supervision (including QA/QC) and instruction to the Construction Contractor. The minimum number of days on site is limited to the Construction Contractor's ability to collect samples.

ADDENDUM NO. 1

ATTACHMENT 1

3e	Disinfection Annual Duration (days)	365
3f	**Annual average power usage (24*3d*3e/1000) kW-hr**	
3g	Unit power cost ($/kW-hr)	$0.10
3h	**Annual average power cost (3f*3g)**	$

4	**Lamp Replacement**	**Value**
4a	Number of Lamps required for a flow rate of 4.5 mgd and meeting the design and performance requirements in Section 13700P (Repeat value from Item 3a).	
4b	Guaranteed Lamp Life, hours each lamp	
4c	Guaranteed Lamp Replacement Cost, $ each lamp (cost guaranteed for five years)	
4d	Disinfection Annual Duration (days)	365
4e	**Lamp Replacement Frequency (4b/(4d*24)), years**	
4f	**Annual lamp replacement cost (4a*4c)/4e**	**$**

Total Present Value Cost Calculation		
Item	**Description**	**Value**
5a	Total Bid Price (Repeat value from Item 1d)	$
5b	**Total Annual Power and Lamp Replacement Operating Cost (sum of Items 3h and 4f)**	$
5c	Operating Period, years	20
5d	Operating Period Discount Rate, %	5
5e	Present Value Factor, P/A (based on 20 years @ 5%)	12.46
5f	**Present Value of Annual Operating Cost (5e*5b), $**	$
5g	**Total Present Value Cost (5a + 5f) for contract award evaluation**	$
	Total Present Value Cost in Words: (Note: In a case of discrepancy, the amount shown in words shall govern)	

PROJECT SPECIFICATIONS AND CONTRACT DOCUMENTS

MAYOR
Elaine M. Scruggs

VICE-MAYOR
Steven E. Frate

COUNCIL MEMBERS
Norma S. Alvarez
Joyce V. Clark
Yvonne J. Knaack
H. Philip Lieberman
Manuel D. Martinez

CITY MANAGER
Ed Beasley

CITY CLERK
Pamela Hanna

CITY ATTORNEY
Craig D. Tindall

CITY ENGINEER
Larry J. Broyles

GLENDALE AZ

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NOTICE TO BIDDERS

Sealed bids shall be either mailed to the City of Glendale Engineering Department, 5850 West Glendale Avenue, Glendale, Arizona, 85301, or hand-delivered to the Engineering Department office, third floor, 5850 West Glendale Avenue, Glendale, Arizona, for furnishing all goods and special services required for: **PROJECT NO. 091033 – ARROWHEAD UV UPGRADE - PROCUREMENT DOCUMENTS FOR NEW UV DISINFECTION SYSTEM.**

The City of Glendale has received an Energy Efficiency and Conservation Block Grant (EECBG) for utilities projects from the Department of Energy (DOE). The City intends to procure an UV disinfection system that will replace the existing medium pressure UV lamp system with an energy efficient low pressure high output UV lamp system at the City of Glendale, Arrowhead Ranch Water Reclamation Facility (ARWRF) at an annual average daily flow of 4.5 million gallons per day (mgd). The new UV lamp system will help ensure effluent water quality compliance, reduced total energy usage, and a reduced carbon footprint. The new UV disinfection system will be installed by a Construction Contractor under a separate contract with the City.

Bids must be received by the Engineering Department of the City of Glendale no later than 2:00 p.m., April 19, 2011. Any bid received after that time will not be considered and will be returned to the bidder. At that time, the bids will be publicly opened and read aloud in the Engineering Department Conference Room, 5850 West Glendale Avenue, Glendale, Arizona.

A mandatory pre-bid conference will be held on April 12, 2011, at 2:00 p.m., in the Engineering Department Conference Room, 5850 West Glendale Avenue, Glendale, Arizona. Bidders, contractors, and other interested parties are invited to attend this conference which will be conducted by the Owner and Engineer to answer any questions. Each Bidder/Contractor in attendance shall sign-in at the pre-bid conference to be given credit for attending.

Plans, specifications and contract documents may be examined, and copies may be obtained at City of Glendale Engineering Department, 5850 West Glendale Avenue, Glendale, Arizona. A non-refundable charge of $50.00 shall be paid for each set of plans and specifications issued from this office.

Each bid shall be in accordance with the plans, specifications and contract documents, and shall be set forth and submitted on the PROPOSAL included with the project specifications book. The PROPOSAL may be removed from the project specifications book and submitted independently of such book. Each bid shall be accompanied by a proposal guarantee, in the form of a certified or cashier's check or bid bond for ten percent (10%) of the amount of bid, made payable to the order of the City of Glendale, Arizona, to insure that the successful bidder will enter into the contract if awarded to him and submit the required Certificate of Insurance, Payment Bond and Performance Bond. All proposal guarantees, except those of the three lowest qualified bidders, will be returned immediately following the opening and checking of proposals. The proposal guarantees of the three lowest qualified bidders will be returned immediately after the contract documents have been executed by the successful bidder. The proposal guarantee shall be declared forfeited as liquidated damages if the successful bidder refuses to enter into said contract or submit the Certificate of Insurance, Payment Bond and Performance Bond after being requested to do so by the City of Glendale, Arizona.

The City of Glendale reserves the right to reject any or all bids or waive any informality or irregularity in a bid. No bidder may withdraw his bid for a period of fifty (50) days after opening and reading of the bids.

The City of Glendale is an equal opportunity employer and minority business enterprises and women's business enterprises are encouraged to submit bids.

CITY OF GLENDALE, ARIZONA

Published: March 31 and April 7, 2011 The Glendale Star

INFORMATION FOR BIDDERS

Note: Whenever the word Bidder is used in this document, it will be synonymous with the word "Contractor", and will have the same meaning.

1. ELIGIBILITY OF BIDDERS: When calling for bids for contracts for public work to be performed on behalf of the State or any political subdivision thereof, which will be paid for from public funds, no bid shall be considered for performance of a contract, including construction work which is not submitted by a bidder duly licensed as a Seller in this State. No bid shall be awarded to any Bidder or entity not authorized to do business in the State of Arizona by the Arizona Corporation Commission, as required by statute.

Bidders shall meet the following minimum qualifications to furnish Goods and Special Services, and Bidder will be required to submit with its Bid written evidence that Items A,B, and C have been met:

A. California Department of Health Certification Requirement

Only systems certified, before bid date, by the State of California Department of Health Services (DHS) under the California Surface Water Treatment Rule (CCR, Title 22, Chapter 17, Section 64650 et. seq.), specifically Section 64653(f) as a conditional approved disinfection technology will be considered for use on this project. The UV disinfection system proposed for this project shall meet all associated design requirements and operating constraints (e.g. dose and effluent bacterial limits) conditional to DHS conditional acceptance of the system. Prospective Bidder shall submit letters showing receipt of Conditional Acceptance.

B. UV System Supplier Experience Requirements

All components of the UV disinfection system shall be designed, coordinated, and supplied by a single manufacturer or supplier, herein referred to as the UV System Supplier (UVSS).

The UVSS (not a subcontractor, employee, or partner) shall have designed, fabricated, and furnished UV disinfection systems on at least five municipal wastewater treatment facilities of at least nine million gallons per day (9 mgd) peak capacity and with a minimum of two (2) years of continuous operation on or before the bid date.

C. Buy-American Requirements

Only suppliers of goods that meet Buy American requirements as outlined in section 1605 of the American Recovery and Reinvestment Act of 2009 will be considered for this project. Documentation of compliance shall be required for any system to be considered for installation under this project.

Such documentation shall include: documented certification from the supplier or manufacturer verifying that the product was manufactured domestically, detailed and verifiable information supporting the claim that the manufactured good has undergone substantial transformation in the United States and/or other reasonable documentation per the discretion of the state, local, or tribal government financial assistance recipient

demonstrating compliance with the Buy American provisions.

2. PROPOSAL: Bids to receive consideration shall be made in accordance with the following instructions:

(a) Before submitting a bid, bidders shall carefully examine the plans and specifications and contract documents, visit the site of the work, and fully inform themselves as to all existing conditions and limitations.

(b) Bids shall be submitted on the "PROPOSAL" forms provided and delivered to the City of Glendale Engineering Department on or before the day and hour set in the "NOTICE TO BIDDERS," as published. Bids shall be enclosed in a sealed envelope marked on the outside lower right-hand corner indicating:

1. The bidder's name and address.
2. The project number.
3. The title of the project.
4. The time and date the bids are to be received.

(c) It is the sole responsibility of the bidder to see that his bid is received in proper time. Any bids received after the scheduled closing time for receipt of bids will be returned to the bidder unopened.

(d) The signatures of all persons shall be in longhand. Any interlineations, alterations, or erasures must be initialed by the signer of the bid.

(e) Bids shall not contain any recapitulations of the work to be done. No oral, telegraphic, telephonic, or modified proposals will be considered.

3. BID SECURITY: Each proposal shall be accompanied by a proposal guarantee in the form of a certified or cashier's check or bid bond, with a properly executed Power of Attorney attached, in an amount equal at least to ten percent (10%) of the total bid price (as shown in Item 5a of the Bid Schedule) payable without condition to the City. If a bid bond is submitted with the bid it shall be issued by a company licensed with the Arizona Department of Insurance and authorized to issue such bonds in this state. **NO BONDS ISSUED BY INDIVIDUAL SURETIES WILL BE ACCEPTED. The company issuing the bid bond shall have a rating of not less than A- in the BEST rating available at the time this project was let to bid**. The proposal guarantee shall guarantee that the bidder, if awarded the contract, will, within ten (10) working days after the award, execute such contract in accordance with the proposal and in manner and form required by the contract documents, and will furnish good and sufficient bond for the faithful performance of the same, a payment bond and a certificate of insurance. The bid securities of the three (3) lowest bidders will be retained until the contract is awarded, or other disposition made thereof. The bid securities of all bidders, except the three (3) lowest, will be returned promptly after the canvass of bids. In the event the Bidder fails, within ten (10) working days after the award, to execute said Contract and deliver the Performance and Labor and Material Payment Bonds and the Certificate of Insurance, the Bid Security shall become the property of the City.

4. WITHDRAWAL OF BID: Any Bidder may withdraw his bid, either personally, by fax or by written request, at any time prior to the scheduled closing time for receipt of bids. No bid may be withdrawn by telephone. Any bid withdrawn will not be opened and will be returned to the bidder.

days from the date of opening and reading.

5. LATE BIDS: Bids received after the scheduled closing time for receipt of bids, as contained in the "Notice to Bidders," will not be considered and will be returned to the bidder.

6. AWARD OR REJECTION OF BIDS: The contract will be awarded to the best qualified responsive bidder complying with these instructions and with the "NOTICE TO CONTRACTORS." Selection will be based on an evaluated bid based on a combination of capital and operations and maintenance costs. The contract will be awarded based on the Total Present Value submitted in Item 5g in the Proposal. The City of Glendale, Arizona, however, reserves the right to accept or reject any or all bids or to waive any or all informalities or irregularities in the bid. Alternates may be accepted depending upon the availability of City funds. Accepted alternates will be considered in determining the lowest responsive and responsible bidder.

7. BIDDERS INTERESTED IN MORE THAN ONE BID: No person, firm or corporation shall be allowed to make, file, or be interested in more than one (1) bid for the same work unless alternate bids are called for in the specifications or any addenda. A person, firm, or corporation who has submitted a sub-proposal to a bidder, or who has quoted prices on materials to a bidder is not thereby disqualified from submitting a sub-proposal or quoting prices to other bidders.

8. CONTRACT AND BONDS: The form of contract, which the successful Bidder will be required to execute and the forms of bonds which he shall be required to furnish are included in the contract documents and should be carefully examined by the bidder. The successful bidder shall use the forms provided or such other forms as are acceptable by the City. The Contract and Performance and Labor and Material Payment Bonds will be executed in three (3) original counterparts. All bonds shall be issued by companies licensed with the Arizona Department of Insurance and authorized to issue such bonds in this state. **NO BONDS ISSUED BY INDIVIDUAL SURETIES WILL BE ACCEPTED. The company issuing any bond shall have a rating of not less than A- in the BEST rating available at the time this project was let to bid.**

9. INSURANCE REQUIREMENTS: Bidder, and each Sub-contractor performing work or providing materials related to this Agreement must procure and maintain the insurance coverages described (collectively, "Contractor's Policies"), until each Parties' obligations under this Agreement are completed. Contractor must at all times relevant hereto carry a commercial general liability policy with a combined single limit of at least $1,000,000 per occurrence and $2,000,000 annual aggregate. **Contracts in excess of $250,000 shall require $2,000,000 single occurrence/$5,000,000 annual aggregate.**

Sub-contractors must at all times relevant hereto carry a general commercial liability policy with a combined single limit of at least $1,000,000 per occurrence.

This commercial general liability insurance must include independent contractors' liability, contractual liability, broad form property coverage, products and completed operations, XCU hazards if requested by the City, and a separation of insurance provision.

These limits may be met through a combination of primary and excess liability coverage.

Auto. A business auto policy providing a liability limit of at least $1,000,000 per accident for Contractor and $1,000,000 per accident for Sub-contractors and covering owned, non-owned and hired automobiles.

Contractor and $1,000,000 per accident for Sub-contractors and covering owned, non-owned and hired automobiles.

Workers' Compensation and Employer's Liability. A workers' compensation and employer's liability policy providing at least the minimum benefits required by Arizona law.

Equipment Insurance. Contractor must secure, pay for, and maintain all-risk insurance as necessary to protect the City against loss of owned, non-owned, rented or leased capital equipment and tools, equipment and scaffolding, staging, towers and forms owned or rented by Contractor or its Sub-contractors.

10. SUBCONTRACTORS LISTING AND CERTIFICATION OF CONTRACT COMPLIANCE: The Bidder will be required to furnish the form of subcontractors listing and certification of contract compliance with the executed contract documents. This information is requested for tracking and insurance purposes only.

11. INTERPRETATION OF PLANS AND DOCUMENTS: If any person contemplating a bid for proposed contract is in doubt as to the true meaning of any part of the plans, specifications, or other proposed contract documents, or finds discrepancies in or omissions from the plans and specifications, he may submit to the Engineering Department, a written request for an interpretation or correction thereof. The person submitting the request will be responsible for its prompt delivery. Questions received less than ninety-six (96) hours before the bid opening time may not be answered. Any interpretation or correction of the documents will be made only by Addendum, duly issued and a copy of such Addendum will be mailed or delivered to each person receiving a set of such documents. The City of Glendale will not be responsible for any other explanations or interpretations of the proposed documents.

12. CHANGES TO PLANS AND DOCUMENTS: Any changes to the plans and documents shall be made only by Addendum. No verbal or other changes to the plans and documents will be valid. A copy of each Addendum will be mailed or delivered as provided in Section 13 below.

13. ADDENDUM: Any addenda will be faxed, mailed or delivered to all who are known by the City to have received a complete set of bid documents, and to offices where bid documents have been filed for review purposes. It is the responsibility of each bidder to ascertain that he has received all addenda issued by telephoning the office identified in the NOTICE TO CONTRACTORS as the location where bid documents are available prior to submitting his bid.

Bidders shall acknowledge all addenda in the appropriate location on the "PROPOSAL" form. Failure to acknowledge receipt of Addenda shall render the bid proposal non-responsive and it will be rejected.

14. ASSIGNMENT OF CONTRACT: No assignment by the Bidder of any contract to be entered into hereunder, or any part thereof, or of funds to be received there under by the Bidder, will be recognized by the Owner unless such assignment has had prior approval of the Owner, and the Surety has been given due notice of such assignment in writing and has consented thereto in writing.

15. PLANS AND SPECIFICATIONS TO SUCCESSFUL BIDDER: The successful Bidder may obtain five (5) sets of plans and specifications for this project from the City.

16. TIME OF COMPLETION: The Bidder shall commence work under this project on or before the tenth day following receipt of the Notice to Proceed for that project from the City of Glendale and shall fully complete all work under the project within the timeframe established in Exhibit A of the Construction Agreement. Time is of the essence in the completion of all work required under this contract. The Bidder shall, at all times, during the continuance of the contract, prosecute the work with such force and equipment as is sufficient to complete all work within the time specified. Liquidated damages associated with failure to meet the specified schedule milestones are given in the Special Provisions.

17. CITY OF GLENDALE TRANSACTION PRIVILEGE TAX: The City of Glendale transaction privilege tax shall **NOT** be waived under the provisions of this contract. The current privilege tax rate can be obtained from the City of Glendale Sales Tax and Licenses Department. The Bidder shall be responsible for reporting and payment of all city, county, state or federal taxes.

18. PRE-BID CONFERENCE: A mandatory pre-bid conference will be held on April 12, 2011, Tuesday, at 2:00 p.m.in the Engineering Department Conference Room, 5850 West Glendale Avenue, Glendale, Arizona. Bidders and other interested parties are invited to attend this conference which will be conducted by the Owner and Engineer to answer any questions.

19. ALTERNATES: Alternate proposals will not be considered unless called for in the documents or any addenda thereto. When alternates are requested, all requested alternates or alternate bid items, unless otherwise stated, shall be bid. If no change in the base bid will occur with the alternate, enter "No Change."

20. APPROVAL OF SUBSTITUTIONS: The materials, products and equipment described in the Documents and Addenda establish a standard or required function, dimension, appearance and quality to be met by any proposed substitution. No substitute will be considered, before bid opening, unless written request for approval has been received by the City Engineer at least ten (10) working days prior to the scheduled closing time for receipt of bids. Each such request shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitute including any drawings, cuts, performance and test data and any other information necessary for evaluation of the substitute. Bidder shall not be entitled to approval of a substitute.

If a substitute is approved, the approval shall be set forth in an Addendum. Bidders shall not rely upon approvals made in any other manner.

21. USE OF "EQUALS": When the specifications for materials, articles, products and equipment state "or equal," Bidder may bid upon, and use materials, articles, products and equipment which will perform equally the duties imposed by the general design. The City Engineering Department will have the final approval of all materials, articles, products and equipment proposed to be used as an "equal." It shall not be purchased or installed without the prior written approval from the City Engineering Department.
Approvals for "equals," before bid opening, may be requested in writing to the City Engineering Department for approval. Requests must be received at least ten (10) days prior to the date set for opening the Bid Proposals. The request shall state the name of the material, article, product or equipment for which the item is sought to be considered an equal and a complete description of the proposed equal including any drawings, cuts, performance and test data and any other information

necessary for approval of the equal. All approvals will be issued in the form of an addendum.

22. TECHNICAL INFORMATION SUBMITTAL: A Technical Information Submittal shall be prepared and be in sufficient detail so that the Buyer can ascertain the Bidders ability to comply with the Project Requirements and Technical Specifications. Four (4) copies of the Technical Submittal shall be submitted with the Bid. Failure to submit the required information shall be grounds for rejection of the bid package. The Bidder shall submit the following documents and data with its Bid:

A. Power Demand Documentation
Documentation of power demand and power draw from two facilities of similar flow, dose and water quality requirements, and utilizing Bidder's equipment.

B. Process Description
Bidder shall provide a written description of the process including all ancillary systems.

C. Process Equipment Layout and Elevation Drawings
Plan and section of the proposed facility layout that clearly identifies dimensional requirements for the proposed system (i.e. Channel length and width, Channel depth, etc.). Preliminary sizing detail for all ancillary electrical and controls equipment shall also be provided and shown on the facility layout to allow for proper determination of building sizing requirements. As all equipment will be located indoors, space shall be included for consumable supplies.

D. List of Exceptions
A detailed list of any exceptions, functional differences, or discrepancies between the Bidder's proposed system and the contract requirements or a statement that there are none. Bidders take note that any exceptions may be justification by Owner for rejection of Bid. All exceptions shall be listed on the first page of the technical submittal. Exceptions that are not clearly identified on the first page of the technical submittal may be cause for rejection of the bid package.

E. Dose Calculations
Complete calculations of achieved dose at peak and average flows. Calculations shall include achieved dose at the maximum available turndown for the system.

F. Total Required Peak Wattage in Proposal - Calculations
Calculations documenting the total power draw for the system under peak flow of 9.0 mgd and including A/C demands (items 2a through 2e in Proposal).

G. Documentation of Power Requirements in Proposal - Calculations.
Calculations documenting the Power Requirements for a flow rate of 4.5 mgd in the Proposal (items 3a through 3d).

H. Guaranteed Lamp Operating Life
Lamp operating life in hours to be guaranteed as stipulated in the technical specifications, and as included in the Proposal.

I. Guaranteed Lamp Replacement Cost
Guaranteed lamp replacement cost for a minimum of 5 years from substantial completion, as stipulated in the technical specifications, and as included in the Proposal (Item 4c).

J. Service Agreement

Service agreement for 5 years beyond substantial completion as defined in the Specifications Section 13700 – Ultraviolet Disinfection System – General Requirements. Guaranteed maximum cost shall be included in the Proposal (Item 1b). Service agreement shall include guaranteed pricing for all consumables as listed in the bid documents.

23. EXAMINATION OF CONTRACT DOCUMENTS AND VISIT SITE: Before submitting a Bid Proposal, Bidders should carefully examine the Contract Documents, visit the site of the work, and fully inform themselves as to all existing conditions and limitations. No consideration will be granted for any alleged misunderstanding of the material, articles or piece of equipment to be furnished or work to be done. It is understood that the tender of the Bid Proposal carries with it the agreement to all items and conditions referred to herein or indicated in the Contract Documents.

24. BIDDERS IN DEFAULT: No bid will be awarded to any person, firm or corporation that is not authorized by the Arizona Corporation Commission to do business in the State of Arizona, in arrears or is in default to the City of Glendale upon any debt or contract, or that is a defaulter as surety or otherwise upon any obligation to the City of Glendale, or has failed to faithfully perform any previous contract with the City of Glendale.

END OF INFORMATION FOR BIDDERS

Project 091033 10

PROPOSAL

Place London, Ontario, Canada

Date April 21, 2011

Proposal of Trojan Technologies , a Corporation organized and existing under the laws of the State of Arizona; a partnership consisting of Argo Canada Holding ULC and Danaher Canada Partners Inc.; or an individual trading as _____.

TO THE HONORABLE MAYOR AND COUNCIL
CITY OF GLENDALE
GLENDALE, ARIZONA

Gentlemen:

The undersigned hereby proposes and agrees to furnish any and all required labor, materials, equipment, and services for the **CITY PROJECT NO. 091033, ARROWHEAD UV UPGRADE – PROCUREMENT DOCUMENTS FOR NEW UV DISINFECTION SYSTEM,** in strict conformity with the plans and specifications for the bid prices listed in the following Bid Schedule:

> We, the undersigned, propose to do all the work and furnish all the labor, physical plant and materials necessary for the work set forth in the Bidding Documents, titled **Project 091033 Arrowhead UV Upgrade – Procurement Documents for New UV Disinfection System.** We further declare that we have carefully read and examined the referenced Bidding Documents that we have made a personal examination of the site, that we understand the exact Scope of the Project, and by making the Bid, declare that we are in compliance with all the requirements thereof.

Bid Schedule

Project Name	Arrowhead UV Upgrade – Procurement Documents for New UV Disinfection System
Project Owner	City of Glendale
COG Project Number	090133

Notes to Bidders

(1) The formulas (for calculated values as formatted in bold letters) in this table are intended to provide the Bidder with a means of checking values used in preparing its Price, and do not relieve the Bidder of complying with the requirements of the Bidding Documents. If the calculations are performed incorrectly such that the calculated values are wrong, City will revise the calculated values using the formulas in the table. Any such revised calculations by the City shall govern, and shall be contractually binding

(2) Bidder shall complete the following schedule. If all of the information in all boxes are not complete, Bidder's bid may be considered to be nonresponsive. All information input or calculated in this table for power consumption (Items 2a through 2e and Items 3a through 3d) shall be the guaranteed value used to compare with the performance testing requirements in Section 13700P – UV Disinfection System – General Requirements.

(3) To determine responsiveness, Bidder shall provide calculations supporting the listed quantities for evaluation by the Engineer. If selected to furnish the Goods and Special Services, the Bidder's annualized project costs, listed herein, shall be guaranteed and shall be clearly stated in the provided warranty.

(4) The UV system performance and design requirements are given in Section 13700P – UV Disinfection System – General Requirements.

(5) Table Key: Standard Weight Text Boxes - Bidder shall enter data into the boxes preceded by standard weight text. **Bold Text** - Information preceded by **bold text** requires a calculation as noted in the description. Boxes that contain pre-populated values shall not be changed by the Bidder.

(6) Contract Award: The award of the UV Disinfection System Procurement Contract shall be based on the lowest total present value cost given in the following Bid Schedule (item 5g). All requested information shall be provided and all available spaces shall be filled in. Failure to comply with the requirements of this bid form shall be grounds for rejection of a Bidder's bid.

(7) Once the award of the contract is made based on stipulation in Item 6 above, the contract price shall be per item 5a – Total Bid Price.

Bidder Information		
Item	**Description**	**Value**
0a	Bidder Company Name	Trojan Technologies
0b	Bidder Business Address	3020 Gore Road
0c	Bidder Business City, State, Zip	London, Ontario, Canada, N5V 4T7
0d	Bidder Contact Name	Jordan Fournier
0e	Bidder Contact Email	jfournier@trojanuv.com
0f	Bidder Contact Phone	519-457-3400 X 2193
0g	Local Representative Company Name	The Coombs Hopkins Company
0h	Local Representative Business Address	668 North 44th Street Suite 251
0i	Local Representative Business City, State, Zip	Phoenix, AZ 85008
0j	Local Representative Contact Name	Jason Vernon Jay Bailey
0k	Local Representative Contact Email	jason@coombshopkins.com jay@coombshopkins.com
0l	Local Representative Contact Phone	602-275-4303

Bid Price for Goods and Special Services		
Item	Description	Value
1a	Bid price for the UV Disinfection System (Goods and Special Services), including all equipment, accessories, submittals, and design assistance for a complete operating system that meets all performance requirements except for the 5-year Service Contract	$1,025,857.65 Includes 9.5% city, state and county Tax
1b	5-Year Service Contract as Specified in Section 13700P,	$55,500
1c	Contract Contingency (The allowance can be used by the Bidder only by written authorization from the CITY. See Special Provisions for more details).	$ 50,000
1d	**Total Bid Price (1a+1b+1c)**	$1,131,357.65
	Total Bid Price in Words: (Note: In a case of discrepancy, the amount shown in words shall govern)	One Million One Hundred Thirty One Thousand Three Hundred Fifty Seven Dollars and Sixty Five Cents

Power Requirements		
Item	Description	Value
2a	Number of lamps required for a peak flow rate of 9.0 mgd and meeting the design and performance requirements in Section 13700P	448
2b	Wattage per lamp required for a peak flow rate of 9.0 mgd and meeting the design and performance requirements in Section 13700P, watts	250
2c	**Total installed lamp wattage (2a *2b)**	112,000
2d	Electrical room A/C wattage based on heat loss generated from electrical equipment requiring A/C at 9.0 mgd, watts	0
2e	**Total required peak wattage, watts (2c+2d)**	112,000

Estimate of Operations and Maintenance Costs		
3	Power	Value
3a	Number of Lamps required for a flow rate of 4.5 mgd and meeting the design and performance requirements in Section 13700P.	224
3b	Wattage per lamp at 4.5 mgd and meeting the design and performance requirements in Section 13700P , watts	250
3c	Electrical room A/C wattage based on heat loss generated from electrical equipment requiring A/C at 4.5 mgd, watts	0
3d	**Total lamp plus A/C wattage at 4.5 mgd, watts ((3a*3b)+3c)**	56,000

3e	Disinfection Annual Duration (days)	365
3f	**Annual average power usage (24*3d/1000) kW-hr *3e (Addendum 1)**	**490,560**
3g	Unit power cost ($/kW-hr)	$0.10
3h	**Annual average power cost (3f*3g)**	**$ 49,056**

4	Lamp Replacement	Value
4a	Number of Lamps required for a flow rate of 4.5 mgd and meeting the design and performance requirements in Section 13700P (Repeat value from Item 3a).	224
4b	Guaranteed Lamp Life, hours each lamp	12,000
4c	Guaranteed Lamp Replacement Cost, $ each lamp (cost guaranteed for five years)	$150
4d	Disinfection Annual Duration (days)	365
4e	**Lamp Replacement Frequency (4b/(4d*24)), years**	1.37
4f	**Annual lamp replacement cost (4a*4c)/4e**	$ 24,526

Total Present Value Cost Calculation		
Item	**Description**	**Value**
5a	Total Bid Price (Repeat value from Item 1d)	$ 1,131,357.65
5b	**Total Annual Power and Lamp Replacement Operating Cost (sum of Items 3h and 4f)**	$ 73,582
5c	Operating Period, years	20
5d	Operating Period Discount Rate, %	5
5e	Present Value Factor, P/A (based on 20 years @ 5%)	12.46
5f	**Present Value of Annual Operating Cost (5e*5b), $**	$ 916,832
5g	**Total Present Value Cost (5a + 5f) for contract award evaluation**	$ 2,048,189.65
	Total Present Value Cost in Words: (Note: In a case of discrepancy, the amount shown in words shall govern)	**Two Million Forty Eight Thousand One Hundred Eighty Nine Thousand Dollars and Sixty Five Cents**

Eligibility Data as described in Instructions to Bidders		
Item	**Description**	**Value**
6a	California DPH Conditional Acceptance Letter (yes/no)	YES
6b	UVSS Experience Confirmation (yes/no)	YES
6c	Buy-American Documentation (yes/no)	YES

Technical Information Submittal as described in Instructions to Bidders		
Item	**Description**	**Value**
7a	Power Demand Documentation (yes/no)	YES
7b	Process Description (yes/no)	YES
7c	Process Equipment Layout and Elevation Drawings (yes/no)	YES
7d	List of Exceptions (yes/no)	YES
7e	Dosage Calculations (yes/no)	YES
7f	Total Required Peak Wattage Calculations (yes/no)	YES
7g	Documentation of Power Requirements in the Proposal (yes/no)	YES
7h	Guaranteed Lamp Operating Life (yes/no)	YES
7i	Guaranteed Lamp Replacement Cost (yes/no)	YES

The undersigned hereby declares that he has visited the site(s) and has carefully examined the contract documents relating to the work covered by the above bid or bids.

Upon receipt of notice of the acceptance of this bid, we will execute the formal contract attached within ten (10) days, and will deliver a one hundred percent (100%) Performance Bond for the faithful performance of this Contract, together with a one hundred percent (100%) Payment Bond and Certificate of Insurance.

The bid security attached, with endorsement, in the sum of ten percent (10%) of the total bid, is to become the property of the City of Glendale, Arizona, in the event the Contract and Bonds are not executed within the time set forth, as liquidated damages for the delay and additional work caused thereby.

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

The undersigned understands that the Mayor and Council of the City of Glendale, Arizona, reserves the right to reject any or all bids or to waive any informalities or irregularities in the bid.

Respectfully submitted,

Trojan Technologies
Bidder

By Jordan Fournier

Title Regional Sales Manager

Firm Trojan Technologies

3020 Gore Road, London, Ontario, Canada, N5V 4T7

(Complete business address)

Telephone Number: (519) 457-3400
Fax Number (519) 457-3030

Bidder shall signify receipt of all Addenda here (if any):

Addendum #1 – April 13, 2011, Addendum #2 – April 15, 2011,
Addendum #3 – April 27, 2011, Addendum #4 – April 27, 2011

Failure to acknowledge receipt of all Addenda shall render the bid proposal non-responsive and will be rejected.

Acknowledged by

Project 091033

CITY CLERK
ORIGINAL

C-7708
06/14/2011

CONSTRUCTION AGREEMENT

This Construction Agreement ("Agreement") is entered into and effective between the CITY OF GLENDALE, an Arizona municipal corporation ("City"), and Trojan Technologies, an Ontario, Canada company "Contractor") as of the 14th day of June, 2011.

RECITALS

A. City intends to undertake a project for the benefit of the public and with public funds that is more fully set forth in the **Notice to Contractors** and the attached **Exhibit A** ("Project");

B. City desires to retain the services of Contractor to perform those specific duties and produce the specific work as set forth in the Project, the plans and specifications, the **Information for Bidders,** and the **Maricopa Association of Governments** ("MAG") **General and Supplemental Conditions and Provisions**;

C. City and Contractor desire to memorialize their agreement with this document.

AGREEMENT

In consideration of the Recitals, which are confirmed as true and correct and incorporated by this reference, the mutual promises and covenants contained in this Agreement, and other good and valuable consideration, City and Contractor agree as follows:

1. Project.

1.1 Scope. Contractor will provide all services and material necessary to assure the Project is completed timely and efficiently consistent with Project requirements, including, but not limited to, working in close interaction and interfacing with City and its designated employees, and working closely with others, including other contractors, providers or consultants retained by City.

1.2 Documents. The following documents are, by this reference, entirely incorporated into this Agreement and attached Exhibits as though fully set forth herein:

(A) Notice to Contractors;
(B) Information for Bidders;
(C) MAG General Conditions, Supplemental General Conditions, Special and Technical Provisions;
(D) Proposal;
(E) Bid Bond;
(F) Payment Bond;
(G) Performance Bond;
(H) Certificate of Insurance;
(I) Appendix**;** and
(J) Plans and Addenda thereto.

Should a conflict exist between this Agreement (and its attachments), and any of the incorporated documents as listed above, the provisions of this Agreement shall govern.

1.3 Project Team.

(A) Project Manager. Contractor will designate an employee as Project Manager with sufficient training, knowledge, and experience to, in the City's opinion, to complete the project and handle all aspects of the Project such that the work produced by Contractor is consistent with applicable standards as detailed in this Agreement.

(B) Project Team.

(1) The Project manager and all other employees assigned to the project by Contractor will comprise the "Project Team."

(2) Project Manager will have responsibility for and will supervise all other employees assigned to the project by Contractor.

(C) Sub-contractors.

(1) Contractor may engage specific technical contractor (each a "Sub-contractor") to furnish certain service functions.

(2) Contractor will remain fully responsible for Sub-contractor's services.

(3) Sub-contractors must be approved by the City, unless the Sub-contractor was previously mentioned in the response to the solicitation.

(4) Contractor shall certify by letter that contracts with Sub-contractors have been executed incorporating requirements and standards as set forth in this Agreement.

2. **Schedule.** The Project will be undertaken in a manner that ensures it is completed in a timely and efficient manner. If not otherwise stated in **Exhibit A**, the Project shall be completed by no later than November 2012.

3. **Contractor's Work.**

3.1 **Standard.** Contractor must perform services in accordance with the standards of due diligence, care, and quality prevailing among contractors having substantial experience with the successful furnishing of services and materials for projects that are equivalent in size, scope, quality, and other criteria under the Project and identified in this Agreement.

3.2 **Licensing.** Contractor warrants that:

(A) Contractor and Sub-contractors will hold all appropriate and required licenses, registrations and other approvals necessary for the lawful furnishing of services ("Approvals"); and

(B) Neither Contractor nor any Sub-contractor has been debarred or otherwise legally excluded from contracting with any federal, state, or local governmental entity ("Debarment").

(1) City is under no obligation to ascertain or confirm the existence or issuance of any Approvals or Debarments or to examine Contractor's contracting ability.

(2) Contractor must notify City immediately if any Approvals or Debarment changes during the Agreement's duration and the failure of the Contractor to notify City as required will constitute a material default of this Agreement.

3.3 **Compliance.** Services and materials will be furnished in compliance with applicable federal, state, county and local statutes, rules, regulations, ordinances, building codes, life safety codes, or other standards and criteria designated by City.

3.4 **Coordination; Interaction.**

(A) If the City determines that the Project requires the coordination of professional services or other providers, Contractor will work in close consultation with City to proactively interact with any other contractors retained by City on the Project ("Coordinating Entities").

(B) Subject to any limitations expressly stated in the budget, Contractor will meet to review the Project, schedules, budget, and in-progress work with Coordinating Entities and the City as often and for durations as City reasonably considers necessary in order to ensure the timely work delivery and Project completion.

(C) If the Project does not involve Coordinating Entities, Contractor will proactively interact with any other contractors when directed by City to obtain or disseminate timely information for the proper execution of the Project.

3.5 **Hazardous Substances.** Contractor is responsible for the appropriate handling, disposal of, and if necessary, any remediation and all losses and damages to the City, associated with the use or release of hazardous substances by Contractor in connection with completion of the Project.

3.6 **Warranties.** At any time within two years after completion of the Project, Contractor must, at Contractor's sole expense and within 20 days of written notice from the City, uncover, correct and remedy all defects in Contractor's work. City will accept a manufacturer's warranty on approved equipment as satisfaction of the Contractor's warranty under this subsection.

3.7. **Bonds.** Upon execution of this Agreement, and if applicable, Contractor must furnish Payment and Performance bonds as required under A.R.S. § 34-608.

4. Compensation for the Project.

4.1 **Compensation.** Contractor's compensation for the Project, including those furnished by its Sub-contractors will not exceed $1,131,357.65, as specifically detailed in the Contractor's bid and set forth in **Exhibit B** ("Compensation").

4.2 **Change in Scope of Project.** The Compensation may be equitably adjusted if the originally contemplated scope of services as outlined in the Project is significantly modified by the City.

(A) Adjustments to the Scope or Compensation require a written amendment to this Agreement and may require City Council approval.

(B) Additional services which are outside the scope of the Project and not contained in this Agreement may not be performed by the Contractor without prior written authorization from the City.

5. Billings and Payment.

5.1 **Applications.**

(A) The Contractor will submit monthly invoices (each, a "Payment Application") to City's Project Manager and City will remit payments based upon the Payment Application as stated below.

(B) The period covered by each Payment Application will be one calendar month ending on the last day of the month.

5.2 **Payment.**

(A) After a full and complete Payment Application is received, City will process and remit payment within 30 days.

(B) Payment may be subject to or conditioned upon City's receipt of:

(1) Completed work generated by Contractor and its Sub-contractors; and

(2) Unconditional waivers and releases on final payment from Sub-contractors as City may reasonably request to assure the Project will be free of claims arising from required performances under this Agreement.

5.3 **Review and Withholding.** City's Project Manager will timely review and certify Payment Applications.

(A) If the Payment Application is rejected, the Project Manager will issue a written listing of the items not approved for payment.

(B) City may withhold an amount sufficient to pay expenses that City reasonably expects to incur in correcting the deficiency or deficiencies rejected for payment.

(C) Contractor will provide, by separate cover, and concurrent with the execution of this Agreement, all required financial information to the City, including City of Glendale Transaction Privilege License and Federal Taxpayer identification numbers.

(D) City will temporarily withhold Compensation amounts as required by A.R.S. 34-221(C).

6. Termination.

6.1 For Convenience. City may terminate this Agreement for convenience, without cause, by delivering a written termination notice stating the effective termination date, which may not be less than 15 days following the date of delivery.

(A) Contractor will be equitably compensated any services and materials furnished prior to receipt of the termination notice and for reasonable costs incurred.

(B) Contractor will also be similarly compensated for any approved effort expended and approved costs incurred that are directly associated with Project closeout and delivery of the required items to the City.

6.2 For Cause. City may terminate this Agreement for cause if Contractor fails to cure any breach of this Agreement within seven days after receipt of written notice specifying the breach.

(A) Contractor will not be entitled to further payment until after City has determined its damages. If City's damages resulting from the breach, as determined by City, are less than the equitable amount due but not paid Contractor for Service and Repair furnished, City will pay the amount due to Contractor, less City's damages.

(B) If City's direct damages exceed amounts otherwise due to Contractor, Contractor must pay the difference to City immediately upon demand; however, Contractor will not be subject to consequential damages more than $1,000,000 or the amount of this Agreement, whichever is greater.

7. Insurance.

7.1 Requirements. Contractor must obtain and maintain the following insurance ("Required Insurance"):

(A) Contractor and Sub-contractors. Contractor, and each Sub-contractor performing work or providing materials related to this Agreement must procure and maintain the insurance coverages described below (collectively, "Contractor's Policies"), until each Parties' obligations under this Agreement are completed.

(B) General Liability.

(1) Contractor must at all times relevant hereto carry a commercial general liability policy with a combined single limit of at least $1,000,000 per occurrence and $2,000,000 annual aggregate.

(2) Sub-contractors must at all times relevant hereto carry a general commercial liability policy with a combined single limit of at least $1,000,000 per occurrence.

(3) This commercial general liability insurance must include independent contractors' liability, contractual liability, broad form property coverage, products and completed operations, XCU hazards if requested by the City, and a separation of insurance provision.

(4) These limits may be met through a combination of primary and excess liability coverage.

(C) Auto. A business auto policy providing a liability limit of at least $1,000,000 per accident for Contractor and 1,000,000 per accident for Sub-contractors and covering owned, non-owned and hired automobiles.

(D) Workers' Compensation and Employer's Liability. A workers' compensation and employer's liability policy providing at least the minimum benefits required by Arizona law.

(E) Equipment Insurance. Contractor must secure, pay for, and maintain all-risk insurance as necessary to protect the City against loss of owned, non-owned, rented or leased capital

equipment and tools, equipment and scaffolding, staging, towers and forms owned or rented by Contractor or its Sub-contractors.

(F) Notice of Changes. Contractor's Policies must provide for not less than 30 days' advance written notice to City Representative of:

(1) Cancellation or termination of Contractor or Sub-contractor's Policies;

(2) Reduction of the coverage limits of any of Contractor or and Sub-contractor's Policies; and

(3) Any other material modification of Contractor or Sub-contractor's Policies related to this Agreement.

(G) Certificates of Insurance.

(1) Within 10 business days after the execution of the Agreement, Contractor must deliver to City Representative certificates of insurance for each of Contractor and Sub-contractor's Policies, which will confirm the existence or issuance of Contractor and Sub-contractor's Policies in accordance with the provisions of this section, and copies of the endorsements of Contractor and Sub-contractor's Policies in accordance with the provisions of this section.

(2) City is and will be under no obligation either to ascertain or confirm the existence or issuance of Contractor and Sub-contractor's Policies, or to examine Contractor and Sub-contractor's Policies, or to inform Contractor or Sub-contractor in the event that any coverage does not comply with the requirements of this section.

(3) Contractor's failure to secure and maintain Contractor Policies and to assure Sub-contractor policies as required will constitute a material default under this Agreement.

(H) Other Contractors or Vendors.

(1) Other contractors or vendors that may be contracted by Contractor with in connection with the Project must procure and maintain insurance coverage as is appropriate to their particular agreement.

(2) This insurance coverage must comply with the requirements set forth above for Contractor's Policies (e.g., the requirements pertaining to endorsements to name the parties as additional insured parties and certificates of insurance).

(I) Policies. Except with respect to workers' compensation and employer's liability coverages, the City must be named and properly endorsed as additional insureds on all liability policies required by this section.

(1) The coverage extended to additional insureds must be primary and must not contribute with any insurance or self insurance policies or programs maintained by the additional insureds.

(2) All insurance policies obtained pursuant to this section must be with companies legally authorized to do business in the State of Arizona and acceptable to all parties.

7.2 Sub-contractors.

(A) Contractor must also cause its Sub-contractors to obtain and maintain the Required Insurance.

(B) City may consider waiving these insurance requirements for a specific Sub-contractor if City is satisfied the amounts required are not commercially available to the Sub-contractor and the insurance the Sub-contractor does have is appropriate for the Sub-contractor's work under this Agreement.

(C) Contractor and Sub-contractors must provide to the City proof of Required Insurance whenever requested.

7.3 Indemnification.

(A) To the fullest extent permitted by law, Contractor must defend, indemnify, and hold harmless City and its elected officials, officers, employees and agents (each, an "Indemnified Party," collectively, the "Indemnified Parties"), for, from, and against any and all claims, demands, actions, damages, judgments, settlements, personal injury (including sickness, disease, death, and bodily harm), property damage (including loss of use), infringement, governmental action and all other losses and expenses, including attorneys' fees and litigation expenses (each, a "Demand or Expense"; collectively, "Demands or Expenses") asserted by a third-party (i.e. a person or entity other than City or Contractor) and that arises out of or results from the breach of this Agreement by the Contractor or the Contractor's negligent actions, errors or omissions (including any Sub-contractor or other person or firm employed by Contractor), whether sustained before or after completion of the Project.

(B) This indemnity and hold harmless policy applies even if a Demand or Expense is in part due to the Indemnified Party's negligence or breach of a responsibility under this Agreement, but in that event, Contractor shall be liable only to the extent the Demand or Expense results from the negligence or breach of a responsibility of Contractor or of any person or entity for whom Contractor is responsible.

(C) Contractor is not required to indemnify any Indemnified Parties for, from, or against any Demand or Expense resulting from the Indemnified Party's sole negligence or other fault solely attributable to the Indemnified Party.

7.4 Waiver of Subrogation. Contractor waives, and will require any Subcontractor to waive, all rights of subrogation against the City to the extent of all losses or damages covered by any policy of insurance.

8. Immigration Law Compliance.

8.1 Contractor, and on behalf any subcontractor, warrants, to the extent applicable under A.R.S. § 41-4401, compliance with all federal immigration laws and regulations that relate to their employees as well as compliance with A.R.S. § 23-214(A) which requires registration and participation with the E-Verify Program.

8.2 Any breach of warranty under subsection 8.1 above is considered a material breach of this Agreement and is subject to penalties up to and including termination of this Agreement.

8.3 City retains the legal right to inspect the papers of any Contractor or subcontractor employee who performs work under this Agreement to ensure that the Contractor or any subcontractor is compliant with the warranty under subsection 8.1 above.

8.4 City may conduct random inspections, and upon request of City, Contractor shall provide copies of papers and records of Contractor demonstrating continued compliance with the warranty under subsection 8.1 above. Contractor agrees to keep papers and records available for inspection by the City during normal business hours and will cooperate with City in exercise of its statutory duties and not deny access to its business premises or applicable papers or records for the purposes of enforcement of this section 8.

8.5 Contractor agrees to incorporate into any subcontracts under this Agreement the same obligations imposed upon Contractor and expressly accrue those obligations directly to the benefit of the City. Contractor also agrees to require any subcontractor to incorporate into each of its own subcontracts under this Agreement the same obligations above and expressly accrue those obligations to the benefit of the City.

8.6 Contractor's warranty and obligations under this section to the City is continuing throughout the term of this Agreement or until such time as the City determines, in its sole discretion, that Arizona law has been modified in that compliance with this section is no longer a requirement.

8.7 The "E-Verify Program" above means the employment verification program administered by the United States Department of Homeland Security, the Social Security Administration, or any successor program.

9. Conflict. Contractor acknowledges this Agreement is subject to A.R.S. § 38-511, which allows for cancellation of this Agreement in the event any person who is significantly involved in initiating, negotiating, securing,

drafting, or creating the Agreement on City's behalf is also an employee, agent, or consultant of any other party to this Agreement.

10. **Prohibitions.** Contractor certifies under A.R.S. §§ 35-391 *et seq.* and 35-393 *et seq.*, that it does not have, and during the term of this Agreement will not have "scrutinized" business operations, as defined in the preceding statutes, in the countries of Sudan or Iran.

11. **Non-Discrimination Policies.** Contractor must not discriminate against any employee or applicant for employment on the basis of race, religion, color sex or national origin. Contractor must develop, implement and maintain non-discrimination policies and post the policies in conspicuous places visible to employees and applicants for employment. Contractor will require any Sub-contractor to be bound to the same requirements as stated within this section.

12. **Notices.**

12.1 A notice, request or other communication that is required or permitted under this Agreement (each a "Notice") will be effective only if:

(A) The Notice is in writing, and

(B) Delivered in person or by private express overnight delivery service (delivery charges prepaid), certified or registered mail (return receipt requested).

(C) Notice will be deemed to have been delivered to the person to whom it is addressed as of the date of receipt, if:

(1) Received on a business day, or before 5:00 p.m., at the address for Notices identified for the Party in this Agreement by U.S. Mail, hand delivery, or overnight courier on or before 5:00 p.m.; or

(2) As of the next business day after receipt, if received after 5:00 p.m.

(D) The burden of proof of the place and time of delivery is upon the Party giving the Notice.

(E) Digitalized signatures and copies of signatures will have the same effect as original signatures.

12.2 **Representatives.**

(A) Contractor. Contractor's representative ("Contractor's Representative") authorized to act on Contractor's behalf with respect to the Project, and his or her address for Notice delivery is:

Jordan Fournier
Trojan Technologies
3020 Gore Road
London, Ontario, Canada N5V 4T7

(B) City. City's representative ("City's Representative") authorized to act on City's behalf, and his or her address for Notice delivery is:

City of Glendale
Attn: Arif Rahman
5850 West Glendale Avenue
Glendale, Arizona 85301

With required copies to:

City of Glendale
City Manager
5850 West Glendale Avenue
Glendale, Arizona 85301

City of Glendale
City Attorney
5850 West Glendale Avenue
Glendale, Arizona 85301

(C) Concurrent Notices.

(1) All notices to City's representative must be given concurrently to City Manager and

City Attorney.

(2) A notice will not be considered to have been received by City's representative until the time that it has also been received by City Manager and City Attorney.

(3) City may appoint one or more designees for the purpose of receiving notice by delivery of a written notice to Contractor identifying the designee(s) and their respective addresses for notices.

(D) **Changes.** Contractor or City may change its representative or information on Notice, by giving Notice of the change in accordance with this section at least ten days prior to the change.

13. **Financing Assignment.** City may assign this Agreement to any City-affiliated entity, including a non-profit corporation or other entity whose primary purpose is to own or manage the Project.

14. **Entire Agreement; Survival; Counterparts; Signatures.**

14.1 Integration. This Agreement contains, except as stated below, the entire agreement between City and Contractor and supersedes all prior conversations and negotiations between the parties regarding the Project or this Agreement.

(A) Neither Party has made any representations, warranties or agreements as to any matters concerning the Agreement's subject matter.

(B) Representations, statements, conditions, or warranties not contained in this Agreement will not be binding on the parties.

(C) Any solicitation, addendums and responses submitted by the Contractor are incorporated fully into this Agreement as Exhibit A. Any inconsistency between Exhibit A and this Agreement will be resolved by the terms and conditions stated in this Agreement.

14.2 Interpretation.

(A) The parties fairly negotiated the Agreement's provisions to the extent they believed necessary and with the legal representation they deemed appropriate.

(B) The parties are of equal bargaining position and this Agreement must be construed equally between the parties without consideration of which of the parties may have drafted this Agreement.

(C) The Agreement will be interpreted in accordance with the laws of the State of Arizona.

14.3 Survival. Except as specifically provided otherwise in this Agreement each warranty, representation, indemnification and hold harmless provision, insurance requirement, and every other right, remedy and responsibility of a Party, will survive completion of the Project, or the earlier termination of this Agreement.

14.4 Amendment. No amendment to this Agreement will be binding unless in writing and executed by the parties. Any amendment may be subject to City Council approval.

14.5 Remedies. All rights and remedies provided in this Agreement are cumulative and the exercise of any one or more right or remedy will not affect any other rights or remedies under this Agreement or applicable law.

14.6 Severability. If any provision of this Agreement is voided or found unenforceable, that determination will not affect the validity of the other provisions, and the voided or unenforceable provision will be reformed to conform to applicable law.

14.7 Counterparts. This Agreement may be executed in counterparts, and all counterparts will together comprise one instrument.

15. **Dispute Resolution.** Each claim, controversy and dispute ("Dispute") between Contractor and City will be resolved in accordance with Exhibit C. The final determination will be made by the City.

16. **Exhibits.** The following exhibits, with reference to the term in which they are first referenced, are incorporated by this reference.

Exhibit A	Project
Exhibit B	Compensation
Exhibit C	Dispute Resolution
Exhibit D	ARRA Funded Project

The parties enter into this Agreement as of the date shown above.

City of Glendale,
an Arizona municipal corporation

By: Ed Beasley
Its: City Manager

ATTEST:

City Clerk (SEAL)

APPROVED AS TO FORM:

City Attorney

TROJAN TECHNOLOGIES
a Canadian company

By: Brent Wager
Its: Project Manager

WOMEN-OWNED/MINORITY BUSINESS [ ] YES [X] NO
CITY OF GLENDALE TRANSACTION PRIVILEGE TAX NO. N/A
FEDERAL TAXPAYER IDENTIFICATION NO. [redacted]

EXHIBIT A
CONSTRUCTION AGREEMENT

PROJECT

SCOPE OF WORK: The scope includes but is not limited to the following:

- Design, fabricate, and deliver a complete UV disinfection system that meets all design and performance requirements in the technical specification and all other stipulations in the contract documents. The Goods and Special Services shall also include preparation of shop drawings and operation and maintenance manuals, coordination with a Construction Contractor, performance testing (field and shop testing), and startup and training services.
- Provide design support to Engineer during development of Construction Contract Documents, including:
  - Submit Technical Submittals as required to adequately define UV disinfection system.
  - Respond to Engineer's questions.
  - Review Construction Bid Documents prepared by Engineer at 30, 60, 90, and 100 percent completion levels and provide technical comments.
  - Attend required meetings with Engineer/Owner.
- Furnish General Contractor Information Package for use by bidders for the construction contract that includes:
  - Final scope of supply with equipment data sheets.
  - Special shipping/handling information/requirements.
  - Special installation requirements.
  - Draft startup plan and schedule.

The contractor agrees to adhere to the following contract times:

Milestone Description	Days from Notice to Proceed
Engineering Phase	
Submit shop drawings and preliminary O&M Manuals	60
Finalize Shop Drawings	60

Milestone Description	Days from Notice to Proceed with Fabrication
Fabrication and Construction Phase	
Deliver goods to facility	180

Milestone Description	Days from Construction Contractor Notice to Complete Performance Testing
Start-up and Commissioning Phase	
Successfully complete performance testing (Section 13704P)	45
Correct all punch list related items	90

EXHIBIT B
CONSTRUCTION AGREEMENT

COMPENSATION

METHOD AND AMOUNT OF COMPENSATION

By bid, including all services, materials and costs.

NOT-TO-EXCEED AMOUNT

The total amount of compensation paid to Contractor for full completion of all work required by the Project during the entire term of the Project shall not exceed $1,131,357.65, without written Amendment by City.

DETAILED PROJECT COMPENSATION

1a	Bid price for the UV Disinfection System	$1,025,857.65
1b	5-Year Service Contract as Specified in Section 13700P	$ 55,500.00
1c	Contract Contingency (The allowance can be used by the Bidder only by written authorization from the City). See Special Provisions for more details).	$ 50,000
1d	**Total Compensation Amount**	**$1,131,357.65**

Payments to the Contractor for Goods and Special Services (except 5-year Service Contract) shall be according to the following schedule as a percentage of the total Bid Price (Bid Schedule Item 1a):

Item #	Milestone Description	Payment Percentage (of Item 1a)
1	Submit shop drawings and preliminary O&M Manuals	5%
2	Finalize shop drawings	10%
3	Notice to proceed with fabrication	15%
4	Deliver goods to facility	40%
5	Complete installation supervision, equipment checkout and functional testing	15%
6	Successfully complete performance testing (Section 13704P)	10%
7	Correct all punch list related items	5%

EXHIBIT C
CONSTRUCTION AGREEMENT

DISPUTE RESOLUTION

1. Disputes.

1.1 Commitment. The parties commit to resolving all disputes promptly, equitably, and in a good-faith, cost-effective manner.

1.2 Application. The provisions of this Exhibit will be used by the parties to resolve all controversies, claims, or disputes ("Dispute") arising out of or related to this Agreement-including Disputes regarding any alleged breaches of this Agreement.

1.3 Initiation. A party may initiate a Dispute by delivery of written notice of the Dispute, including the specifics of the Dispute, to the Representative of the other party as required in this Agreement.

1.4 Informal Resolution. When a Dispute notice is given, the parties will designate a member of their senior management who will be authorized to expeditiously resolve the Dispute.

(A) The parties will provide each other with reasonable access during normal business hours to any and all non-privileged records, information and data pertaining to any Dispute in order to assist in resolving the Dispute as expeditiously and cost effectively as possible;

(B) The parties' senior managers will meet within 10 business days to discuss and attempt to resolve the Dispute promptly, equitably, and in a good faith manner, and

(C) The Senior Managers will agree to subsequent meetings if both parties agree that further meetings are necessary to reach a resolution of the Dispute.

2. Arbitration.

2.1 Rules. If the parties are unable to resolve the Dispute by negotiation within 30 days from the Dispute notice, and unless otherwise informal discussions are extended by the mutual agreement, the Dispute will be decided by binding arbitration in accordance with Construction Industry Rules of the AAA, as amended herein. Although the arbitration will be conducted in accordance with AAA Rules, it will not be administered by the AAA, but will be heard independently.

(A) The parties will exercise best efforts to select an arbitrator within 5 business days after agreement for arbitration. If the parties have not agreed upon an arbitrator within this period, the parties will submit the selection of the arbitrator to one of the principals of the mediation firm of Scott & Skelly, LLC, who will then select the arbitrator. The parties will equally share the fees and costs incurred in the selection of the arbitrator.

(B) The arbitrator selected must be an attorney with at least 15 years experience with commercial construction legal matters in Maricopa County, Arizona, be independent, impartial, and not have engaged in any business for or adverse to either Party for at least 10 years.

2.2 Discovery. The extent and the time set for discovery will be as determined by the arbitrator. Each Party must, however, within ten (10) days of selection of an arbitrator deliver to the other Party copies of all documents in the delivering party's possession that are relevant to the dispute.

2.3 Hearing. The arbitration hearing will be held within 90 days of the appointment of the arbitrator. The arbitration hearing, all proceedings, and all discovery will be conducted in Glendale, Arizona unless otherwise agreed by the parties or required as a result of witness location. Telephonic hearings and other reasonable arrangements may be used to minimize costs.

2.4 Award. At the arbitration hearing, each Party will submit its position to the arbitrator, evidence to support that position, and the exact award sought in this matter with specificity. The arbitrator must select the award sought by one of the parties as the final judgment and may not independently alter or modify the awards sought by the parties, fashion any remedy, or make any equitable order. The arbitrator has no authority to consider or award punitive damages.

2.5 Final Decision. The Arbitrator's decision should be rendered within 15 days after the arbitration hearing is concluded. This decision will be final and binding on the Parties.

2.6 Costs. The prevailing party may enter the arbitration in any court having jurisdiction in order to convert it to a judgment. The non-prevailing party shall pay all of the prevailing party's arbitration costs and expenses, including reasonable attorney's fees and costs.

3. Services to Continue Pending Dispute. Unless otherwise agreed to in writing, Contractor must continue to perform and maintain progress of required services during any Dispute resolution or arbitration proceedings, and City will continue to make payment to Contractor in accordance with this Agreement.

4. Exceptions.

4.1 Third Party Claims. City and Contractor are not required to arbitrate any third-party claim, cross-claim, counter claim, or other claim or defense of a third-party who is not obligated by contract to arbitrate disputes with City and Contractor.

4.2 Liens. City or Contractor may commence and prosecute a civil action to contest a lien or stop notice, or enforce any lien or stop notice, but only to the extent the lien or stop notice the Party seeks to enforce is enforceable under Arizona Law, including, without limitation, an action under A.R.S. § 33-420, without the necessity of initiating or exhausting the procedures of this Exhibit.

4.3 Governmental Actions. This Exhibit does not apply to, and must not be construed to require arbitration of, any claims, actions or other process filed or issued by City of Glendale Building Safety Department or any other agency of City acting in its governmental permitting or other regulatory capacity.

EXHIBIT D

CONSTRUCTION AGREEMENT

ARRA FUNDED PROJECTS

1. ARRA Funded Project.

1.1 Funding for this Project has been provided through the American Recovery and Reinvestment Act of 2009 ("ARRA), Pub. L. 111-5. This Project is thus subject to all appropriate ARRA requirements as prescribed in the ARRA and its implementing regulations and rules under federal law.

1.2 The Contractors and its subcontractors are subject to audit by appropriate federal or Arizona entities. The City and State of Arizona has the right to cancel, terminate or suspend the Agreement if the Contractor or its subcontractors, fail to comply with any reporting, registration or operational requirements by ARRA.

1.3 Contractor agrees to provide the City with the following information on a monthly basis:

(A) The total amount of ARRA funds received by Contractor during the preceding calendar month;

(B) The amount of ARRA funds that were expended or obligated during the preceding calendar month; and

(C) A detailed list of all projects or activities for which ARRA funds were expended or obligated.

INDIVIDUAL SURETIES WILL NOT BE ACCEPTED

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

KNOW ALL MEN BY THESE PRESENTS:

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

WHEREAS, The Principal has entered into a certain written contract with the Obligee, dated the ____ day of , 20___, to provide Goods and Special Services for the **ARROWHEAD UV UPGRADE – PROCUREMENT DOCUMENTS FOR NEW UV DISINFECTION SYSTEM (PROJECT NO. 091033)**, which contract is hereby referred to and made a part hereof as fully and to the same extent as if copied at length herein.

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

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

The prevailing party or any party which recovers judgment on this bond shall be entitled to such reasonable attorney's fees as may be fixed by the court or a judge thereof.

Witness our hands this _____ day of_____, 20____.

_____
Principal Seal

By_____

_____
Surety Seal

_____
Agency of Record

_____
Agency Address

Telephone Number: _____

INDIVIDUAL SURETIES WILL NOT BE ACCEPTED

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

KNOW ALL MEN BY THESE PRESENTS:

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

WHEREAS, The Principal has entered into a certain written contract with the Obligee, dated the _____ day of , 20_____, to provide Goods and Special Services for the **ARROWHEAD UV UPGRADE – PROCUREMENT DOCUMENTS FOR NEW UV DISINFECTION SYSTEM (PROJECT NO. 091033)** WHICH contract is hereby referred to and made a part hereof as fully and to the same extent as if copied at length herein.

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

PROVIDED, HOWEVER, that this bond having been required of the said Principal in order to comply with the provisions of Title 34, Chapter 2, Article 2, of the Arizona Revised Statutes, all rights and remedies on this bond shall inure solely to such persons and shall be determined in accordance with the provisions, conditions, and limitations of said Title, Chapter and Article, to the same extent as if they were copied at length herein.

The prevailing party or any party which recovers judgment on this bond shall be entitled to such reasonable attorney's fees as may be fixed by the court or a judge thereof.

Witness our hands this _____ day of_____, 20____.

_____
Principal Seal

By_____

_____
Surety Seal

_____
Agency of Record

_____
Agency Address

Telephone Number: _____

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 07/04/2011

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

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

PRODUCER
MARSH USA INC.
SUITE 400
1255 23RD STREET, N.W.
WASHINGTON, DC 20037
Attn: Danaher.certrequest@marsh.com Fax (212) 948-0503
040108-ALL-ALL-11-12 TROJA

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

INSURER(S) AFFORDING COVERAGE		NAIC #
INSURER A :	ACE American Insurance Company	22667
INSURER B :	Indemnity Ins Co Of North America	43575
INSURER C :	National Union Fire Ins Co Pittsburgh PA	19445
INSURER D :	ACE Insurance Company	30953
INSURER E :		
INSURER F :		

INSURED
TROJAN TECHNOLOGIES
DANAHER CORPORATION
2200 PENNSYLVANIA AVE, NW
SUITE 800W
WASHINGTON, DC 20037

COVERAGES **CERTIFICATE NUMBER:** CLE-003702208-01 **REVISION NUMBER:** 5

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

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	**GENERAL LIABILITY**			HDO G25530329	07/01/2011	07/01/2012	EACH OCCURRENCE	$ 2,000,000
	X COMMERCIAL GENERAL LIABILITY						DAMAGE TO RENTED PREMISES (Ea occurrence)	$ 300,000
	CLAIMS-MADE X OCCUR						MED EXP (Any one person)	$ 10,000
	X Contractual Liability						PERSONAL & ADV INJURY	$ 2,000,000
	X Broad Form PD						GENERAL AGGREGATE	$ 5,000,000
	GEN'L AGGREGATE LIMIT APPLIES PER:						PRODUCTS - COMP/OP AGG	$ 2,000,000
	X POLICY PRO-JECT LOC							$
A	**AUTOMOBILE LIABILITY**			ISA H08635730 (AOS)	07/01/2011	07/01/2012	COMBINED SINGLE LIMIT (Ea accident)	$ 3,000,000
D	X ANY AUTO			28PR200569 (Puerto Rico)	07/01/2011	07/01/2012	BODILY INJURY (Per person)	$
	ALL OWNED AUTOS / SCHEDULED AUTOS						BODILY INJURY (Per accident)	$
	HIRED AUTOS / NON-OWNED AUTOS						PROPERTY DAMAGE (Per accident)	$
								$
C	X **UMBRELLA LIAB** X OCCUR			25030389	07/01/2011	07/01/2012	EACH OCCURRENCE	$ 5,000,000
	EXCESS LIAB CLAIMS-MADE						AGGREGATE	$ 5,000,000
	DED RETENTION $							$
B	**WORKERS COMPENSATION AND EMPLOYERS' LIABILITY**			WLR C46481707 (AOS)	07/01/2011	07/01/2012	X WC STATU-TORY LIMITS OTH-ER	
A	ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? Y/N N	N/A		WLR C46481689 (CA,MA)	07/01/2011	07/01/2012	E.L. EACH ACCIDENT	$ 2,000,000
A	**(Mandatory in NH)** If yes, describe under DESCRIPTION OF OPERATIONS below			SCF C46481690 (WI)	07/01/2011	07/01/2012	E.L. DISEASE - EA EMPLOYEE	$ 2,000,000
							E.L. DISEASE - POLICY LIMIT	$ 2,000,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (Attach ACORD 101, Additional Remarks Schedule, if more space is required)

CERTIFICATE HOLDER

CITY OF GLENDALE
5850 W GLENDALE
GLENDALE, AZ 85301

CANCELLATION

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

AUTHORIZED REPRESENTATIVE
of Marsh USA Inc.

Agneta Jernbeck Baker Agneta Jernbeck Baker

ADDITIONAL INFORMATION

CLE-003702208-01

DATE (MM/DD/YY)
07/04/2011

PRODUCER
MARSH USA INC.
SUITE 400
1255 23RD STREET, N.W.
WASHINGTON, DC 20037
Attn: Danaher.certrequest@marsh.com Fax (212) 948-0503
040108-ALL-ALL-11-12 TROJA

INSURERS AFFORDING COVERAGE	NAIC #
INSURER G:	
INSURER H:	
INSURER I:	
INSURER J:	

INSURED
TROJAN TECHNOLOGIES
DANAHER CORPORATION
2200 PENNSYLVANIA AVE, NW
SUITE 800W
WASHINGTON, DC 20037

TEXT

If additional insured status has been granted by the Named Insured via a written contract, the following will apply:

The Certificate Holder is included as an additional insured with respect to premises leased to or by the named insured and operations of the named insured. Additionally, the Certificate Holder is an additional insured with respect to the distribution or sale, in the normal course of business, of any merchandise or products manufactured, sold, handled or distributed by the named insured, provided the insurance with respect to the Certificate Holder shall apply only to losses and/or claims based upon manufacture or sale of merchandise or products of the named insured, or materials contained therein, and said insurance shall not apply to:

1. The negligence or contract breach of the Certificate Holder or any other person or organization other than the named insured;
2. Any express warranty not authorized in writing by the named insured;
3. The sale of any merchandise or product for a purpose not intended by the named insured;
4. The alteration, packaging, repackaging, repair or modification of any merchandise or product of the named insured without the express written approval by the named insured, and/or;
5. The sale of named insured's merchandise or products without all instructions and warnings provided by the named insured.

The insurance provided will not exceed the lesser of:

1. The coverage and limits of insurance of the applicable policy, or
2. The coverage and limits of insurance required by said contract or agreement.

If the contract to which this certificate relates provides for a waiver of subrogation for the benefit of the Certificate Holder, the insurance company agrees to waive its rights of recovery against the Certificate Holder except as follows:
1. Injuries, damage or loss caused, in whole or in part, by the negligence or contract breach of the Certificate Holder, and/or any person or organization other than the Named Insured.
2. Injuries, damage or loss caused, in whole or in part, by defects in the premises, equipment, products, or appurtenances of the Certificate Holder.

This certificate supersedes all previous certificates issued by named insured evidenced on first page.

CERTIFICATE HOLDER

CITY OF GLENDALE
5850 W GLENDALE
GLENDALE, AZ 85301

AUTHORIZED REPRESENTATIVE
of Marsh USA Inc.
Agneta Jernbeck Baker

Agneta Jernbeck Baker

CITY OF GLENDALE, ARIZONA
PUBLIC WORKS/ENGINEERING DEPARTMENT

CONTRACTOR'S AFFIDAVIT
REGARDING
SETTLEMENT OF CLAIMS

ARROWHEAD RANCH UV UPGRADE – PROCUREMENT DOCUMENTS FOR NEW UV DISINFECTION SYSTEM (PROJECT NO. 091033)

To the City of Glendale, Arizona

Gentlemen:

This is to certify that all lawful claims for materials, rental of equipment and labor used in connection with the construction of the above project, whether by subcontractor or claimant in person, have been duly discharged.

The undersigned, for the consideration of $_____ , as set out in the final pay estimate, as full and complete payment under the terms of the contract, hereby waives and relinquishes any and all further claims or right of lien under, in connection with, or as a result of the above described project. The undersigned further agrees to indemnify and save harmless the City of Glendale against any and all liens, claims of liens, suits, actions, damages, charges, costs, litigation expenses, attorneys' fees and any other and expenses whatsoever, which said City may suffer arising out of the failure of the undersigned to pay for all labor performance and materials furnished for the performance of said installation.

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

_____
Contractor

By _____

STATE OF ARIZONA)
) ss.
COUNTY OF MARICOPA)

The foregoing instrument was subscribed and sworn to before me this ___ day of _____, 20___.

_____
Notary Public

My Commission Expires: _____

SUPPLEMENTAL GENERAL CONDITIONS

Supplemental General Conditions are not included in this contract. Refer to Special Provisions for additional contract requirements.

END OF SUPPLEMENTAL GENERAL CONDITIONS

SPECIAL PROVISIONS

1. GENERAL: By Ordinance No. 1110 New Series, the City of Glendale adopted the "Uniform Standard Specifications for Public Works Construction," which are sponsored and distributed by the Maricopa Association of Governments. Copies of these documents, with revisions, are on file in the office of the City Engineer of the City of Glendale, and are hereby made a part of these Contract Documents.

   Whenever in the Uniform Standard Specifications, the words "The Contracting Agency" are used, the meaning shall be the City of Glendale.

   In all cases where ASTM, AASHTO, AWWA, USAG, Federal, City of Phoenix, MAG Specifications, Maricopa County, Arizona State Highway, or other standard specifications are referred to, unless otherwise stated, revisions, supplements or addenda issued on or before the date of this contract, shall prevail. In the event of any conflict between these project specifications and the requirements of the plans, detail drawings, MAG Standard Details and Specifications, these project specifications shall prevail.

2. SCOPE OF WORK: The goods, materials, labor, and special services to be provided under the Contract Documents are described as follows:

   - Design, fabricate, and deliver a complete UV disinfection system that meets all design and performance requirements given technical specifications and contract documents. The goods, materials, labor, and special services shall also include, but are not limited to, preparation of shop drawings and operation and maintenance manuals, coordination with a Construction Contractor, performance testing (field and shop testing), and startup and training services.

   - Provide design support to Engineer during development of Construction Contract Documents, including:
     - Technical Submittals as required to adequately define UV disinfection system.
     - Response to Engineer's questions during design and construction phase of the UV Facilities at Arrowhead Water Reclamation Facility.
     - Review of Construction Bid Documents prepared by Engineer at 30, 60, 90, and 100 percent completion levels and providing technical comments.
     - Attending required meetings with Engineer/Owner.
   - Furnish Construction Contractor Information Package for use by the construction contractor that includes:
     - Final scope of supply with equipment data sheets.
     - Special shipping/handling information/requirements.
     - Special installation requirements.
     - Draft startup plan and schedule.

3. DEFINITIONS: The following terms as used in or pertaining to the Contract Documents, are defined as follows:

   CITY: The word "City" refers to the City of Glendale, Arizona. The official representative of said City in these proceedings shall be the City Engineer.

   CONTRACTOR: The word "Contractor" means the person, firm, or corporation with whom the Contract is made by the City.

   CONTRACT DOCUMENTS: The words "Contract Documents" mean the Notice to Bidders, Information for Bidders, "Uniform Standard Specifications for Public Works Construction," Special Provisions, Technical Specifications, Proposal, Contract, Payment Bond, Performance Bond, Certificates of Insurance, Plans and Addenda thereto. **Special Note: Supplemental General Conditions mentioned in the Construction Agreement have been excluded from this contract.**

BIDDER: A person, firm, or corporation that submits a Bid directly to the City. Bidder is synonymous to the words "Contractor", "Vendor", "UV System Supplier" or "Seller" in these contract documents.

BUYER: The person or public entity purchasing the goods, materials, labor, and special services. Buyer shall be synonymous with "City" and "Owner."

CONSTRUCTION CONTRACTOR: The words "Construction Contractor" mean the firm or corporation that will install the Goods under a separate agreement with the Buyer. The Goods furnished under this contract will be furnished through the CITY to the Construction Contractor for installation.

CONTRACT PRICE: The money payable by Buyer to Seller for furnishing the Goods and Special Services in accordance with the Contract Documents as stated in the Agreement.

DRAWINGS: That part of the Contract Documents prepared or approved by Engineer which graphically shows the scope, intent, and character of the Goods and Special Services to be furnished by Seller.

ENGINEER: The word "Engineer" means a person, firm or corporation duly authorized by the City, to act for the City in staking out the work, inspecting materials and construction, and interpreting plans and specifications.

GOODS: The tangible and movable personal property that is described in the Contract Documents.

MATERIALS: The term "Materials" includes, in addition to goods (or materials) furnished as part of the project, equipment and other material used and/or consumed in the performance of the work.

SECTION: Reference to a MAG Section on the plans or in these Specifications shall mean a Section of the Uniform Standard Specifications for Public Works Construction, sponsored and distributed by Maricopa Association of Governments (MAG), latest revision. The provisions of MAG Uniform Standard Specifications and Details for Public Works Construction, which are not altered or modified by the drawings or by these Special Provisions or by any subsequently issued Addendum, shall apply to the contract even though the Contractor's attention is not specifically drawn to such provisions.

SELLER: The word "Seller" means the person, firm, or corporation who, by winning award of the contract enters into an agreement with the Buyer to furnish the Goods and Special Services.

SHOP DRAWINGS: All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Seller and submitted by Seller to illustrate some portion of the Goods or Special Services.

SPECIAL SERVICES: All services associated with the Goods to be furnished by Seller as required by the Contract Documents.

Definition of any additional items, not defined above or elsewhere in the contract documents, shall be per MAG Section 101.2.

STANDARD DETAIL: Reference to a MAG Standard Detail (MAG S.D.) on the plans or in these specifications shall mean a standard detail drawing in the latest revision of the Uniform Standard Specifications for Public Works Construction, sponsored and distributed by Maricopa Association of Governments. City of Glendale Standard Detail (C.O.G. S.D.) shall mean a standard detail drawing in the City of Glendale's Engineering Design and Construction Standards, latest revision. City of Phoenix Standard Detail (C.O.P. S.D.) shall mean a standard detail drawing in the Phoenix Supplemental Standard Details for Public Works Construction, latest revision.

SUBCONTRACTOR: The word "Subcontractor" includes those having a direct contract with the Contractor and those who furnish material worked to a special design according to the plans and/or specifications for this work, but does not include those who merely furnish materials not so worked.

SUCCESSFUL BIDDER: The lowest responsible Bidder submitting a Bid, to whom Buyer makes an award.

TECHNICAL SPECIFICATIONS: That part of the Contract Documents consisting of written technical descriptions of materials, equipment, systems, standards and workmanship as applied to the furnishing of the Goods and Special Services, and certain administrative details applicable thereto.

PROPOSAL QUANTITIES: It is expressly understood and agreed by the parties hereto that the quantities of the various classes of work to be done and material to be furnished under this Contract, which have been estimated as stated in the Proposal, are only approximate and are to be used SOLELY for the purpose of comparing, on a consistent basis, the proposals offered for the work under this Contract; and the Contractor further agrees that the City will not be held responsible if any of the quantities shall be found incorrect; and the Contractor will not make any claim for damages or for loss of profits because of a difference between the quantities of the various classes of work as estimated and the work actually done. If any error, omission, or mis-statement is found to occur in the estimated quantities, the same shall not invalidate this Contract or release the Contractor from the execution and completion of the whole or any part of the work in accordance with the specifications and the plans herein mentioned, or for the prices herein agreed upon and fixed therefore, or excuse him from any of the obligations or liabilities hereunder, or entitle him to any damages or compensation except as may be provided for in this Contract.

4. LOSSES AND DAMAGES: All loss or damage arising out of the nature of the work to be done or from the action of the elements, or from any unforeseen circumstances in the prosecution of the same, or from any unusual obstructions or difficulties which may be encountered in and/or during the prosecution of the work, or from any casualty whatsoever of every description, shall be sustained and borne by the Contractor at his own cost and expense except as otherwise provided by the contract documents or the laws of the State of Arizona.

5. SHOP DRAWINGS: The Contractor shall provide shop drawings as may be necessary for the prosecution of the work as required by the contract documents. The Engineer shall promptly review all shop drawings. The Engineer's approval of any shop drawing shall not release the Contractor from responsibility for deviations from the contract documents. The approval of any shop drawing which substantially deviates from the requirements of the contract documents shall be evidenced by a change order.

   When submitted for the Engineer's review, shop drawings shall bear the contractor's certification that he has reviewed, checked, and approved the shop drawings and that they are in conformance with the requirements of the contract documents.

   Portions of the work requiring a shop drawing or sample submission shall not begin until the shop drawing or sample submission has been approved by the Engineer. A copy of each approved shop drawing and each approved sample shall be kept in good order by the Contractor at the site and shall be available to the Engineer.

6. PROTECTION OF FINISHED OR PARTIALLY FINISHED WORK: The Contractor shall properly guard and protect all finished or partially finished work, and shall be responsible for the same until the entire contract is completed and accepted, in writing, by the City. The Contractor shall turn over the entire work in full accordance with the specifications before final settlement shall be made.

7. STATUS OF EMPLOYEES: Contractor shall be responsible for assuring the legal working status of its employees and its subcontractor's employees.

8. LAWS AND REGULATIONS: This Contract shall be governed by and constructed in accordance with the laws of the State of Arizona. The Contractor shall keep himself fully informed of all existing and future City and County Ordinances and Regulations and State and Federal Laws and Occupational Safety and Health Standards (OSHA) in any manner affecting the work herein specified. He shall at all times observe and comply with said Ordinances, Regulations, or Laws.

9. PERMITS: The City has obtained certain required permits which are included in the project specifications, but it will be the duty of the Contractor to determine that all the necessary permits have been obtained. The Contractor shall, at his own expense, obtain all required permits which have not been furnished by the City.

10. PRE-CONSTRUCTION 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 Engineer will schedule a Pre-Construction Conference. This will be held at the City of Glendale, 5850 West Glendale Avenue, Glendale, Arizona.

    The purpose of this Conference is to establish a working relationship between the Contractor, Utility Companies, and the Engineer. The agenda will include critical elements of the construction schedule, procedures for handling shop drawings and other submittals, cost breakdown of major lump sum items, payment application and processing, coordination with the involved utility companies, emergency telephone numbers for all representatives involved in the course of construction, and establishment of the Notice to Proceed date.

    Minimum attendance by the Contractor shall be a responsible official of the company/corporation, who is authorized to execute and sign documents on behalf of the company/corporation.

11. CONTRACTOR'S CONSTRUCTION SCHEDULE: Concurrently, with the execution of the contract and prior to the pre-construction conference, the Contractor shall submit a preliminary schedule for the Engineer's acceptance. The schedule shall be in sufficient detail to allow the Engineer to determine if the proposed schedule will conform to an approved program of construction operations, as determined by the contracting agency. Within ten calendar days after the preliminary schedule, described above, has been approved by the Engineer, the Contractor shall submit a progress schedule, utilizing the critical path method scheduling technique, showing the order in which he proposes to carry out the work, the dates on which he will start each phase of the work, and the contemplated date for completion of each phase. The Contractor shall not be permitted to commence construction until the schedule complying with this paragraph has been submitted to the City. The Contractor will not be granted any extension to the contract time or compensation for any damages as a result of the City's refusal to allow Contractor to commence construction until the critical path method progress schedule has been submitted and approved by the Engineer.

    The critical path method (CPM) scheduling technique requires a breakdown of the entire work into individual tasks and an analysis of the number of days required to perform each task. The schedule submitted to the City should highlight and identify the critical path for the project. After the work is in progress, the Contractor shall submit supplementary progress schedules, using the critical path method technique, of the progress to date and projection for completion. The supplementary progress schedules shall be submitted with each pay request in accordance with the paragraph, "Payments to Contractors," of these Supplemental General Conditions. The progress schedules shall be subject to the approval of the Engineer. In the event the Contractor fails to submit a supplementary progress schedule acceptable to the Engineer, the City may withhold further progress payments to the Contractor until the Contractor submits an acceptable supplementary progress schedule, which is approved by the Engineer, to the City. Schedule changes requiring an increase in the City's engineering personnel on the project shall not be put into effect until the Engineer has approved such increase and made arrangements for the required additional personnel.

12. HINDRANCES AND DELAYS: Except as otherwise provided herein, no charge shall be made by the Contractor for hindrances or delays from any cause during the progress of the work embraced in this Contract; but such delays, if due to no fault or neglect of the Contractor, shall entitle the Contractor to an extension of time allowed for completing the work, sufficient to compensate for the delay, the amount of the delay to be determined by the Engineer, provided the Contractor shall give said Engineer immediate notice in writing of the cause of such delay.

12.1 Delay: In the event of a delay for which the City is solely responsible, which is unreasonable under the circumstances and which was not within the contemplation of City and Contractor at the time this Contract is executed, City and Contractor shall negotiate, in good faith, a payment by the City to Contractor for the expenses incurred by Contractor as a result of such delay, in accordance with the City of Glendale Engineering Department's POLICY STATEMENT FOR CALCULATING DELAYS AND DAMAGES. This provision shall not be construed to void any provision in the contract which requires notice of delay or provides for liquidated damages. However, if the delay is the result of any act or neglect of a third party, including the architect, engineer or other contractor employed by the City, or by labor disputes, fire, unusual delay in transportation, adverse weather conditions not reasonably foreseeable, unavoidable casualties, or any causes beyond the Contractor's control, the Contractor shall not be entitled to any payments or compensation for expenses incurred as a result of such delay, but the Contract Time shall be extended by Change Order for such reasonable time as the Engineer may determine. No extension or compensation will be granted for any delay which is the result, wholly or partially, of any act or neglect of Contractor or any Subcontractor hired by Contractor.

13. PAYMENTS TO CONTRACTOR: The measurements of quantities and the payments to the Contractor shall be in accordance with MAG Uniform Standard Specifications for Public Works Construction, Part 100 - General Conditions, Section 109 - Measurements and Payments.

    Completed work generated by Contractor will compensated in accordance with the payment schedule described in the Agreement, Exhibit B.

    The pay estimate shall be accompanied by an updated progress schedule as required by these Supplemental General Conditions and a cash flow report when required by the Special Provisions. Approval of progress payments shall be conditional upon submittal of progress schedules and cash flow reports, when required, which are acceptable to the Engineer.

    Upon 100% completion and acceptance of the project, and with the request for final payment, the Contractor shall complete and submit the "Contractor's Affidavit Regarding Settlement of Claims" form which is included in these specifications. Before final payment and release of retention, Contractor must arrange for its Surety to provide the City with a fully executed AIA Consent of Surety form. To avoid delays in the final payment, the Surety may send the Consent of Surety directly to the City via fax at (623) 915-2689, and mail the original to the City of Glendale Engineering Department, 5850 West Glendale Avenue, Glendale, Arizona 85301. Should any ambiguity arise between the Contract and these Conditions, the provisions of the Contract shall prevail.

14. SUSPENSION OF WORK: The Engineer reserves the right to suspend the work wholly or in part if deemed necessary for the best interest of the City. This suspension will be without compensation to the Contractor, other than to adjust the contract time in accordance with MAG Section 108.

15. COMPLIANCE WITH MANUFACTURER'S INSTRUCTIONS: In all instances wherein the item and/or specifications require installation or construction in accordance with manufacturers or supplier's recommendations and/or instructions, said recommendations and/or instructions shall be submitted with the applicable portions clearly marked for approval prior to the commencement of work on that item or portion of the contract.

16. CASH FLOW REPORT: The Contractor shall prepare a Cash Flow Report for projected monthly project cash flow on a City provided form and submit it for approval prior to issuance of the Notice

to Proceed. The accumulation of monthly pay estimate costs shall be plotted versus time in accordance with the proposed construction schedule. After approval, the Contractor shall submit an updated Cash Flow Report prior to the receipt of each Progress Payment. Each updated Cash Flow Report shall reflect the Contractor's actual monthly payment versus the actual elapsed contract time.

At the City's request, if the projected quarterly project cash flow varies by more than ten percent of the total contract price, the Contractor shall prepare a revised Cash Flow Report. Each revised Cash Flow Report is subject to approval by the City prior to issuance of the progress payment.

Revisions to the report resulting from Contractor initiated delays or work schedule changes shall be at no cost to the City. Any revisions required by City initiated delays or changes to the work shall be paid as an integral part of the approved Change Order.

17. SCHEDULE MILESTONES. The below Milestones, the delivery of Goods and the Special Services, shall be furnished to the Buyer according to the schedule given in the Agreement, Exhibit A.

18. LIQUIDATED DAMAGES. Buyer and Seller recognize that time is of the essence of this Agreement and that Buyer will suffer financial loss if the Good and Special Services are not furnished with the time specified in the Agreement. Further, they recognize the delays, expense and difficulties involved in proving the actual loss suffered by Buyer if complete acceptable Goods and Special Services are not delivered on time. Accordingly, instead of requiring such proof, Buyer and Seller agree that as liquidated damages for delay (but not as a penalty) Seller shall pay Buyer for each day that expires after the milestone dates specified in the Agreement for furnishing of acceptable Goods and Special Services the following:

No.	Description/Milestone	Cost
1	Submit Shop Drawings and Preliminary O&M Manuals	$200/day
2	Finalize Shop Drawings	$200/day
3	Deliver Goods to Facility	$500/day
4	Successfully Complete Performance Testing (Section 13704P)	$500/day
5	Correct all punch list related items	$200/day

19. PAYMENT SCHEDULE: Completed work generated by Seller and its Sub-contractors [dfb1]will be compensated as described in the Agreement, Exhibit B.

21. ALLOWANCE FOR CONSTRUCTION CONTINGENCIES: Bid schedule includes a lump sum contingency allowance. This allowance is at all times the property of the City and is for the sole purpose of reimbursing Contractor for any unforeseen work not apparent at the time of bidding or additional work requested by the CITY OF GLENDALE.

No work anticipated for reimbursement under this Bid Item shall be initiated by Contractor until Contractor, City of Glendale Representative and City of Glendale agree on the scope and cost to perform the additional work. The Contractor shall prepare and submit to City of Glendale Representative a cost itemization and summary for the additional work. City of Glendale Representative and City of Glendale shall review and approve prior to Contractor proceeding with any additional work. Any portion of the stated sum not expended remains the property of the City of Glendale.

END OF SPECIAL PROVISIONS

Project Life Cycle
Cash Flow Schedule

Project No.: _____ Date: _____

Project Name: _____

Company Name:

Project Start Date: _____ Project Completion Date _____

Original ☐ Updated ☐ Revised ☐

		Estimated		Actual	
Qtr.	Fiscal Yr.	Amount	Accum.	Amount	Accum.
1st	07/06 - 09/06				
2nd	10/06 - 12/06				
3rd	01/07 - 03-07				
4th	04/07 - 06/07				
1st	07/07 - 09/07				
2nd	10/07 - 12/07				
3rd	01/08 - 03/08				
4th	04/08 - 06/08				
1st	07/08 - 09/08				
2nd	10/08 - 12/08				
3rd	01/09 - 03/09				
4th	04/09 - 06/09				
1st	07/09 - 09/09				
2nd	10/09 - 12/09				
3rd	01/10 - 03/10				
4th	04/10 - 06/10				
1st	07/10 - 09/10				
2nd	10/10 - 12/10				
3rd	01/11 - 03/11				
4th	04/11- 06/11				
	Totals	$ -	$ -	$ -	$ -

* COG's fiscal year is July 1, (current year) through June 30, (following year)

For Engineering Use Only:

Account No: _____ PO No. _____

Master Form

CITY OF GLENDALE

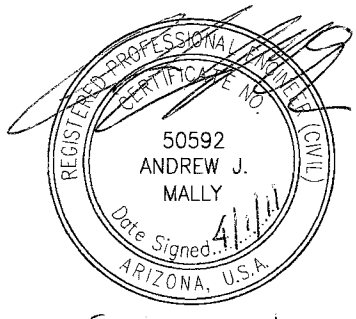
PROJECT 091033

ARROWHEAD UV UPGRADE

PROCUREMENT DOCUMENTS FOR NEW DISINFECTION SYSTEM

TECHNICAL SPECIFICATIONS

April 2011



Expires 3/31/2013

BLACK & VEATCH
Corporation

CITY OF GLENDALE
ARROWHEAD RANCH WATER RECLAMATION FACILITY UV UPGRADE
UV DISINFECTION SYSTEM PROCUREMENT
CONTRACT DOCUMENTS

TABLE OF CONTENTS

Section 01300P

SUBMITTALS

1. SHOP DRAWINGS AND ENGINEERING DATA.

1.01. General. Shop Drawings and engineering data (submittals) covering all equipment and all fabricated components and building materials which will become a permanent part of the Work under this Contract shall be submitted to Engineer for review, as required. Submittals shall verify compliance with the Contract Documents and the Bid Form, and shall include drawings and descriptive information in sufficient detail to show the kind, size, arrangement, and the operation of component materials and devices; the external connections, anchorages, and supports required; the performance characteristics; and dimensions needed for installation and correlation with other materials and equipment.

The submittal shall cover all items included in the specifications organized such that each individual component is easily referenced. The Ultraviolet System Supplier (UVSS) shall submit a complete preliminary submittal including all components with the bid package as outlined in the "Instructions to Bidders" section. When an item consists of components from multiple sources, UVSS's preliminary submittal shall be complete including all components.

All submittal components, regardless of origin, shall be reviewed and approved by the UVSS and clearly identified with the name and number of this Contract, UVSS's name, and references to applicable specification paragraphs and/or Contract Drawings. Each copy of all submittals shall be stamped or affixed with an approval statement from the UVSS. Each subsection of the submittal shall indicate the intended use of the item in the Work. When catalog pages are submitted, applicable items shall be clearly identified and inapplicable data crossed out. The current revision, issue number, and date shall be indicated on all drawings and other descriptive data.

The UVSS shall be solely responsible for the completeness of each submittal. The UVSS's stamp or affixed approval statement of the submittal is a representation to Owner and Engineer that UVSS accepts sole responsibility for determining and verifying all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data, and that UVSS has reviewed and coordinated each submittal with the requirements of the Work and the Contract Documents.

All deviations from the Contract Documents shall be identified as deviations on each submittal and shall be tabulated in UVSS's letter of transmittal. Such submittals shall, as pertinent to the deviation, indicate essential details of all

changes proposed by UVSS (including modifications to other facilities that may be a result of the deviation) and all required piping and wiring diagrams. Deviations from the contract documents not included in the supplier's original bid package will not be considered or may be cause for rejection of the supplier.

Five copies of each drawing and the necessary data shall be submitted to Engineer. Engineer will return two marked copies (or one marked reproducible copy) to UVSS. Facsimile (fax) or electronic copies will not be acceptable unless mutually agreed upon by the Owner, Engineer and UVSS. If electronic submittals are desired, the UVSS may submit a formal request in writing to the Owner. Engineer will not accept submittals from anyone but UVSS. Submittals shall be consecutively numbered in direct sequence of submittal and without division by subcontracts or trades.

1.02. Engineer's Review of Submittals. Engineer's review of submittals covers only general conformity to the Contract Documents, external connections, and dimensions that affect the layout; it does not indicate thorough review of all dimensions, quantities, and details of the material, equipment, device, or item covered. Engineer's review shall not relieve UVSS of sole responsibility for errors, omissions, or deviations in the drawings and data, nor of UVSS's sole responsibility for compliance with the Contract Documents.

Engineer's submittal review period shall be 28 consecutive calendar days and shall commence on the first calendar day following receipt of the submittal or resubmittal in Engineer's office. The time required to mail the submittal or resubmittal back to UVSS shall not be considered a part of the submittal review period.

When the drawings and data are returned with review status "NOT ACCEPTABLE" or "RETURNED FOR CORRECTION", the corrections shall be made as instructed by Engineer. Five corrected copies shall be resubmitted. Resubmittals by facsimile or e-mail will not be acceptable unless mutually agreed upon by the Owner, Engineer and UVSS. If electronic submittals are desired, the UVSS may submit a formal request in writing to the Owner. When the drawings and data are returned with review status "EXCEPTIONS NOTED", "NO EXCEPTIONS NOTED", or "RECORD COPY", no additional copies need be furnished unless specifically requested by Engineer.

1.03. Resubmittal of Drawings and Data. UVSS shall accept full responsibility for the completeness of each resubmittal. UVSS shall verify that all corrected data and additional information previously requested by Engineer are provided on the resubmittal.

When corrected copies are submitted, UVSS shall direct specific attention to all revisions in writing and shall list separately any revisions made other than those called for by Engineer on previous submittals. Requirements specified for initial

submittals shall also apply to resubmittals. Resubmittals shall bear the number of the first submittal followed by a letter (A, B, etc.) or a unique identification that indicates the initial submittal and correct sequence of each resubmittal.

If more than one resubmittal is required because of failure of UVSS to provide all previously requested corrected data or additional information, UVSS shall reimburse Owner for the charges of Engineer for review of the additional resubmittals. This does not include initial submittal data such as shop tests and field tests that are submitted after initial submittal.

Resubmittals shall be made within 30 days of the date of the letter returning the material to be modified or corrected, unless within 14 days UVSS submits an acceptable request for an extension of the stipulated time period, listing the reasons the resubmittal cannot be completed within that time.

The need for more than one resubmittal, or any other delay in obtaining Engineer's review of submittals, will not entitle UVSS to extension of the Contract Times unless delay of the Work is the direct result of a change in the Work authorized by a Change Order or failure of Engineer to review and return any submittal to UVSS within the specified review period.

1.04. Color Selection. UVSS shall submit samples of colors and finishes for all accepted products before Engineer will coordinate the selection of colors and finishes with Owner. Engineer will prepare a schedule of finishes that include the colors and finishes selected for both manufactured products and for surfaces to be field painted or finished and will furnish this schedule to UVSS within 60 days after the date of acceptance of the last color or finish sample.

2. OPERATION AND MAINTENANCE DATA AND MANUALS. Adequate operation and maintenance information shall be supplied for all equipment requiring maintenance or other attention. The equipment Supplier shall prepare a project specific operation and maintenance manual for each type of equipment indicated in the individual equipment sections or the equipment schedule.

Parts lists and operating and maintenance instructions shall be furnished for other equipment not listed in the individual equipment sections or the equipment schedule.

Operation and maintenance manuals shall include the following:

a. Equipment function, normal operating characteristics, and limiting conditions.

b. Assembly, installation, alignment, adjustment, and checking instructions.

c. Operating instructions for startup, routine and normal operation, regulation and control, shutdown, and emergency conditions.

d. Lubrication and maintenance instructions.

e. Guide to troubleshooting of process equipment including impacts from water quality changes, mechanical and electrical systems. Ancillary equipment supplied by, but not manufactured by the UVSS shall be included as well.

f. Parts lists and predicted life of parts subject to wear.

g. Outline, cross section, and assembly drawings; engineering data; and wiring diagrams.

h. Test data and performance curves, where applicable.

The operation and maintenance manuals shall be in addition to any instructions or parts lists packed with or attached to the equipment when delivered, or which may be required by UVSS.

2.01. Hard Copy Operation and Maintenance Manuals. Hard copies submitted for review shall be temporarily bound in heavy paper covers bearing suitable identification. All manuals and other data shall be printed on heavy, first quality 8-1/2 x 11 inch paper, with standard three-hole punching. Drawings and diagrams shall be reduced to 8-1/2 x 11 inches or 11 x 17 inches. Where reduction is not practicable, larger drawings shall be folded separately and placed in envelopes, which are bound into the manuals. Each envelope shall be suitably identified on the outside. Each volume containing data for three or more items of equipment shall include a table of contents and index tabs. The final hard copy of each manual shall be prepared and delivered in substantial, permanent, three-ring or three-post binders with a table of contents and suitable index tabs. Three hard copies of the final O&M manuals shall be submitted.

2.02. Electronic Operation and Maintenance Manuals. Electronic manuals shall be in Adobe Acrobat's Portable Document Format (PDF), and shall be prepared at a resolution between 300 and 600 dots per inch (dpi), depending on document type. Optical Character Recognition (OCR) capture shall be performed on these documents. OCR settings shall be performed with the "original image with hidden text" option in Adobe Acrobat Exchange. Two electronic copies of the final O&M manual shall be submitted on CD affixed with the UVSS's label.

File size shall be limited to 10 MB. When multiple files are required the least number of files possible shall be created. File names shall be in the format OMXXXXX-YYYZ-V.pdf, where XXXXX is the five digit number corresponding to the specification section, YYY is a three digit O&M manual number, e.g. 001, Z is

the letter signifying a resubmittal, A, B, C, etc, and V is a number used only when more than one 10 MB file is required for an O&M manual.

Documents prepared in PDF format shall be processed as follows:

1. Pages shall be searchable (processed for optical character recognition) and indexed when multiple files are required.
2. Pages shall be rotated for viewing in proper orientation.
3. A bookmark shall be provided in the navigation frame for each entry in the Table of Contents.
4. Embedded thumbnails shall be generated for each completed PDF file.
5. The opening view for PDF files shall be as follows:
   Initial View: Bookmarks and Page
   Page Number: Title Page (usually Page 1)
   Magnification: Set to Fit in Window
   Page: Single Page
6. Where the bookmark structure is longer than one page the bookmarks shall be collapsed to show the chapter headings only.
7. When multiple files are required the first file of the series (the parent file) shall list every major topic in the Table of Contents. The parent file shall also include minor headings bookmarked based on the Table of Contents. Major headings, whose content is contained in subsequent files (children) shall be linked to be called from the parent to the specific location in the child file. The child file shall contain bookmark entries for both major and minor headings contained in the child file. The first bookmark of any child file shall link back to the parent file and shall read as follows "Return to the *Equipment Name* Table of Contents", e.g. Return to the Polymer Feed System Table of Contents.
8. Drawings shall be bookmarked individually.
9. Files shall be delivered without security settings to permit editing, insertion and deletion of material to update the manual provided by the manufacturer.

2.03. Labeling. As a minimum, the following information shall be included on all final O&M manual materials, including CD-ROM disks, jewel cases, and hard copy manuals:

Equipment name and/or O&M title spelled out in complete words.
Project Name.
City Project/Contract Number.
Specification Section Number. Example: "Section 15500"
Manufacturer's name.
File Name and Date.

For example:

Backwash Pump Operation and Maintenance Manual
Somewhere Plant Expansion
Project/Contract No. _____
Specification Section 11110
Manufacturer
OM11110-001.pdf, 5/05/07

End of Section

Section 01610P

GENERAL EQUIPMENT STIPULATIONS

1. SCOPE. When an equipment specification section in this Contract references this section, the equipment shall conform to the general stipulations set forth in this section, except as otherwise specified in other sections. If requirements listed in this section are in conflict with the individual equipment sections, the equipment specification shall govern.

2. COORDINATION. The equipment supplied under this project shall be purchased by the Owner and provided to a Contractor for installation. The UV System Supplier (UVSS) shall coordinate manufacturing, shipment, verification of proper installation and all performance testing with the Owner, Engineer and the selected Contractor.

3. MANUFACTURER'S EXPERIENCE. Unless specifically named in the Specifications, a manufacturer shall have furnished equipment of the type and size specified which has been in successful operation for not less than the past 5 years.

4. WORKMANSHIP AND MATERIALS. The UVSS shall guarantee all equipment against faulty or inadequate design, improper assembly or erection, defective workmanship or materials, and leakage, breakage, or other failure specific to the manufacturing and supply of the equipment. Materials shall be suitable for service conditions as specified in the specific equipment sections.

All equipment shall be designed, fabricated, and assembled in accordance with recognized and acceptable engineering and shop practice. Individual parts shall be manufactured to standard sizes and thicknesses 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 by tests.

Except where otherwise specified, structural and miscellaneous fabricated steel used in equipment shall conform to AISC standards. All structural members shall be designed for shock or vibratory loads. Unless otherwise specified, all steel which will be submerged, all or in part, during normal operation of the equipment shall be at least 1/4 inch thick. When dissimilar metal components are used, consideration shall be given to prevention of galvanic corrosion.

5. LUBRICATION. Equipment shall be adequately lubricated by systems which require attention no more frequently than weekly during continuous operation. Lubrication systems shall not require attention during startup or shutdown and shall not waste lubricants.

Lubricants of the types recommended by the equipment manufacturer shall be provided in sufficient quantities to fill all lubricant reservoirs and to replace all consumption during testing, startup, and operation prior to acceptance of equipment by Owner.

Lubrication facilities shall be convenient and accessible. Oil drains and fill openings shall be easily accessible from the normal operating area or platform. Drains shall allow for convenient collection of waste oil in containers from the normal operating area or platform without removing the unit from its normal installed position.

6. ELEVATION. The elevation of the site shall be as indicated in the respective equipment specification sections. All equipment furnished shall be designed to meet stipulated conditions and to operate satisfactorily at the specified elevation.

7. ELECTRIC MOTORS. Unless otherwise specified, motors furnished with equipment shall meet the requirements specified in the specific equipment sections.

8. DRIVE UNITS. The nominal input horsepower rating of each gear or speed reducer shall be at least equal to the nameplate horsepower of the drive motor. Drive units shall be designed for 24 hour continuous service.

8.01. Gearmotors. The use of gearmotors sharing an integral housing or cutgears into the motor output shaft, or that require removal of lubricant from the gear reducer to change out the motor will not be acceptable.

8.02. Gear Reducers. Each gear reducer shall be a totally enclosed unit with oil or grease lubricated, rolling element, antifriction bearings throughout.

Unless superseded by individual specification requirements each helical, spiral bevel, combination bevel-helical, and worm gear reducers shall have a service factor of at least 1.50 based on the nameplate horsepower of the drive motor. Cycloidal gear reducers shall have a service factor of at least 2.0 based on the nameplate horsepower of the drive motor. Shaft-mounted and flange-mounted gear reducers shall be rated AGMA Class III. Helical gear reducers shall have a gear strength rating to catalog rating of 1.5. Each gear reducer shall be designed and manufactured in compliance with applicable most current AGMA standards, except the L_{10} bearing life shall be 200,000 hours.

The thermal horsepower rating of each unit shall equal or exceed the nameplate horsepower of the drive motor. During continuous operation, the maximum sump oil temperature shall not rise more than 100°F above the ambient air temperature in the vicinity of the unit and shall not exceed 200°F.

Each grease lubricated bearing shall be installed in a bearing housing designed to facilitate periodic regreasing of the bearing by means of a manually operated grease gun. Each bearing housing shall be designed to evenly distribute new grease, to properly dispose of old grease, and to prevent overgreasing of the bearing. The use of permanently sealed, grease lubricated bearings will not be acceptable in large sized reducers. In small reducers, similar to basin equipment, permanently sealed grease lubricated bearings rated L_{10} 200,000 hour life may be provided at the manufacturer's option. An internal or external oil pump and appurtenances shall be provided if required to properly lubricate oil lubricated bearings. A dipstick or a sight glass arranged to permit visual inspection of lubricant level shall be provided on each unit.

Gear reducers which require the removal of parts or the periodic disassembly of the unit for cleaning and manual regreasing of bearings will not be acceptable.

Certification shall be furnished by the gear reducer manufacturer indicating that the intended application of each unit has been reviewed in detail by the manufacturer and that the unit provided is fully compatible with the conditions of installation and service.

8.03. Adjustable Speed Drives. Each mechanical adjustable speed drive shall have a service factor of at least 1.75 at maximum speed based on the nameplate horsepower of the drive motor. A spare belt shall be provided with each adjustable speed drive unit employing a belt for speed change. Unless specifically permitted by the detailed equipment specifications, bracket type mounting will not be acceptable for variable speed drives.

8.04. V-Belt Drives. Each V-belt drive shall include a sliding base or other suitable tension adjustment. V-belt drives shall have a service factor of at least 1.75 at maximum speed based on the nameplate horsepower of the drive motor.

9. SAFETY GUARDS. All belt or chain drives, fan blades, couplings, and other moving or rotating parts shall be covered on all sides by a safety guard. Safety guards shall be fabricated from 16 USS gage thick or thicker galvanized, aluminum-clad sheet steel, or stainless sheet steel or from 1/2 inch mesh galvanized expanded metal, or poltrusion molded UV resistant materials. Each safety guard shall be reinforced or shaped to provide suitable strength to prevent vibration and deflection and shall comply with OSHA. Each guard shall be designed for easy installation and removal. All necessary supports and accessories shall be provided for each guard. Supports and accessories, including bolts, shall be galvanized. All safety guards in outdoor locations shall be designed to prevent the entrance of rain and dripping water.

10. ANCHOR BOLTS. Equipment suppliers shall determine suitable anchor bolts for each item of equipment. Anchor bolts, together with templates or setting drawings, shall be delivered sufficiently early to permit setting the anchor bolts when the structural concrete is placed. Anchor bolts shall comply with the Anchorage in Concrete and Masonry section and, unless otherwise specified, shall be at least 3/4 inch in diameter. Anchor bolts shall be provided by the Contractor subject to the approval of the UVSS.

Unless otherwise indicated or specified, anchor bolts for items of equipment mounted on base plates shall be long enough to permit 1-1/2 inches of grout beneath the base plate and to provide adequate anchorage into structural concrete.

11. EQUIPMENT BASES. Unless otherwise indicated or specified, all equipment shall be installed on concrete bases at least 6 inches high. Cast iron or welded steel base plates shall be provided for pumps, compressors, and other equipment. Each unit and its drive assembly shall be supported on a single base plate of neat design. Base plates shall have pads for anchoring all components, and adequate grout holes. Base plates for pumps shall have a means for collecting leakage and a threaded drain connection. Base plates shall be anchored to the concrete base with suitable anchor bolts and the space beneath filled with grout.

12. SPECIAL TOOLS AND ACCESSORIES. Equipment requiring periodic repair and adjustment shall be furnished complete with all special tools, instruments, and accessories required for proper maintenance. Equipment requiring special devices for lifting or handling shall be furnished complete with those devices.

13. SHOP PAINTING. All iron and steel surfaces of the equipment shall be protected with suitable protective coatings applied in the shop. Surfaces of the equipment that will be inaccessible after assembly shall be protected for the life of the equipment. Coatings shall be suitable for the environment where the equipment is installed. Exposed surfaces shall be finished, thoroughly cleaned, and filled as necessary to provide a smooth, uniform base for painting. Electric motors, speed reducers, starters, and other self-contained or enclosed components shall be shop primed or finished with an epoxy or polyurethane enamel or universal type primer suitable for top coating in the field with a universal primer and aliphatic polyurethane system.

Surfaces to be coated after installation shall be prepared for painting as recommended by the paint manufacturer for the intended service, and then shop painted with one or more coats of a universal primer.

Machined, polished, and nonferrous surfaces which are not to be painted shall be coated with rust-preventive compound as recommended by the equipment manufacturer.

14. PREPARATION FOR SHIPMENT. Equipment shall be prepared for shipment as specified in Section 01612 - Shipping.

15. STORAGE. Handling and storage of equipment shall be as recommended by the UVSS and shall be stipulated by the UVSS in the shop drawing submittals.

16. INSTALLATION AND OPERATION. Installation and operation shall be as specified in respective equipment sections and Section 01650 Startup Requirements.

17. OBSERVATION OF PERFORMANCE TESTS. Where the Specifications require the presence of Engineer, initial tests shall be observed or witnessed by Engineer. Owner shall be reimbursed by the UVSS for all costs of subsequent visits by Engineer to witness or observe incomplete tests, retesting, or subsequent tests.

18. PROGRAMMING SOFTWARE. Programming software shall be provided for any equipment which includes a programmable logic controller (PLC) or other digital controller that is user-programmable. The software shall be suitable for loading and running on a laptop personal computer operating with a Windows-based operating system. A copy of the UVSS's original operating logic program shall be provided for use in maintaining and troubleshooting the equipment. Where multiple pieces of equipment, from the same or different vendors, use the same programming software, only one copy of the software need be provided.

End of Section

Section 01612P

SHIPPING

1. SCOPE. This section covers packaging and shipping of materials and equipment. The UVSS is responsible for all packaging and shipping.

2. PREPARATION FOR SHIPMENT. All equipment shall be suitably packaged to facilitate handling and to protect against damage during transit and storage. All equipment shall be boxed, crated, or otherwise completely enclosed and protected during shipment, handling, and storage. All equipment shall be protected from exposure to the elements and shall be kept dry at all times.

Painted and coated surfaces shall be protected against impact, abrasion, discoloration, and other damage. Painted and coated surfaces which are damaged prior to acceptance of equipment shall be repainted to the satisfaction of Engineer.

Grease and lubricating oil shall be applied to all bearings and similar items.

3. SHIPPING. Before shipping each item of equipment shall be tagged or marked as identified in the delivery schedule or on the Shop Drawings. Complete packing lists and bills of material shall be included with each shipment.

End of Section

Section 01650P

STARTUP REQUIREMENTS

1. SCOPE. This section covers startup requirements for all equipment and systems. Additional requirements are specified in the specific equipment specifications. The requirements of this section shall be satisfactorily completed prior to any field performance tests specified in Section 13704P – Ultraviolet Disinfection System Performance and Validation Testing.

2. GENERAL. Equipment shall not be operated except by, or with the guidance of, qualified personnel having the knowledge and experience necessary to obtain proper results. All equipment and systems shall be tested for proper operation, efficiency, and capacity. All required adjustments, tests, operation checks, and other startup activity shall be provided by qualified personnel. The Ultraviolet System Supplier (UVSS) shall be responsible for planning, supervising, and executing manufacture of the equipment and shall supervise the installation of the equipment as required by the Contractor.

2.01. Coordination. The UVSS shall coordinate all tests related to startup of equipment and systems when they are requested by the Contractor and shall report the results to Engineer in accordance with the submittals section.

When equipment is ready for a witness test, the UVSS shall give written notice to the Engineer that the system has been installed within the requirements established by the UVSS. Testing protocols shall be submitted with the shop drawings. The UVSS shall notify the Engineer at least 14 days before any offsite witness testing is performed or any field witnessed performance testing, unless otherwise specified.

3. EQUIPMENT TESTS. All equipment testing shall be in accordance with Section 13704P – Ultraviolet Disinfection System Performance and Validation Testing.

4. ACCEPTANCE. When no other field tests for acceptance are specified in the equipment sections, at the end of the field system operation testing, each system will be accepted if, in the opinion of Engineer, it has operated satisfactorily without excessive power use, wear, or need for lubrication, or requiring undue attention; and if all its rotating parts operate without excessive vibration or noise at any operating condition.

When other field tests for acceptance are specified in the equipment sections, acceptance shall be after all tests are satisfactorily conducted as specified in the appropriate equipment specifications.

When a field performance test for baseline is specified in the equipment sections, acceptance shall be after a completion of the baseline performance test that is conducted as specified in the pumping unit field testing - baseline performance section.

Acceptance of Work in connection with the installation of equipment furnished by others will be subject to approval of the manufacturer's field representative. Acceptance by Owner or approval of the manufacturer's field representative will not relieve UVSS of responsibility for defective Work.

End of Section

Section 13530P

PROGRAMMABLE LOGIC CONTROLLERS and INSTRUMENTS

PART 1 - GENERAL

1-1. SCOPE. This section covers programmable logic controllers (PLCs), associated input/output hardware, PLC accessories, communication devices and instrument equipment provided by the UV System Supplier. The PLC shall include inputs and outputs as required by the UVSS for control of the UV system. Additionally, the UVSS shall supply a list of all available I/O from the UV system for integration into the existing plant control system.

All ancillary cabling, connectors and terminations shall be provided as necessary for a complete and operating system. Cables to connect a laptop computer to the PLC shall also be provided.

1-2. GENERAL. Equipment furnished and installed under this section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with the drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

1-3. SPARE PARTS. Spare parts shall be furnished as follows:

Spare Part	Quantity
Processor modules	1 of each type used
Power supply modules	1 of each type used
I/O modules	1 of each type used
Communications modules	1 of each type used

PART 2 - PRODUCTS

2-1. GENERAL. All equipment furnished under this section shall be expressly selected for its superior quality for the intended purpose and shall comply with the following requirements.

2-1.01. Interchangeability. All programmable logic controller systems shall be products of the same manufacturer and of the same series or product line. Processors, local and remote input/output hardware, communications modules, and specialty modules such as coprocessors and ASCII modules shall be interchangeable among all I/O panels and systems. PLC modules and hardware

by other manufacturers will be acceptable only if the PLC manufacturer does not offer suitable modules and hardware for the same functions.

2-1.02. Initial, Spare, and Future Memory (RAM). System Supplier shall provide adequate memory for the amount of I/O, control algorithms, and communications in the initial system.

Each programmable logic controller shall include provisions for future expansion and shall have 100 percent spare memory capacity and 100 percent spare data capacity installed. The spare memory capacity shall be documented by submitting to Engineer, during factory testing, a statement indicating the amounts of memory of all types being utilized and the total amount available in each system. The statement shall include an estimate of the total program and data memory necessary, including spare memory, based on the I/O hardware for the system, and previous programming experience.

2-1.03. Spare I/O. Each PLC input/output enclosure shall be provided with at least 20 percent spare inputs and outputs of each type. Spare I/O shall be installed, wired, and interfaced properly to the terminal strip. The spare I/O shall be in addition to any I/O installed and reserved for future process signals as may be indicated on the I/O list. In addition, each PLC input/output enclosure shall be capable of accommodating 20 percent of additional input/output capacity of each type as originally assembled, without the need for additional expansion racks, communication adapters, cables, or PLC power supplies.

2-1.04. Signal Power Supplies. Regulated dc power supplies shall be provided in each PLC enclosure as required. . Power supplies shall be suitable for an input voltage variation of ±10 percent, and the supply output shall be fused or protected against short-circuiting. Output voltage regulation shall be as required by the instrumentation equipment supplied under another section.

The loop power supply shall be separate from the power supply circuit for the processor and racks.

The power source for all digital inputs from field devices shall be separately fused for each digital input module. Unless otherwise noted, all field devices will be provided with dry contacts that close to provide an input to the PLC.

2-1.05. Appurtenances. The PLC processor and I/O hardware shall be provided as complete systems. The PLCs shall include all necessary hardware and software for a complete working system. All special rack or panel mounted power supplies, special interconnecting and programming cables, special grounding hardware, or isolation devices shall be furnished for proper operation of the equipment. Signal converters, signal boosters, amplifiers, special power supplies, special cable, special grounding, intrinsically safe relays and current

repeaters, surge suppression devices, and isolation devices shall be furnished and installed for proper operation of the equipment.

2-1.06. PLC Arrangement. The PLCs shall be distributed and arranged as indicated on the drawings.

2-1.07. Service Conditions. PLCs will be installed in air conditioned rooms

2-2. PLC PROCESSOR. The programmable logic controller processor shall be an industrial type, modular unit to be mounted and connected to a PLC rack system and be capable of managing multiple racks up to 1024 points of I/O. The PLC shall have 4,096 kB for internal user RAM, 1,792 kB for base program, constant, and symbol memory; and 256 kB for located and unlocated variables.

2-2.01. Acceptable Manufacturer. The PLC hardware configuration shall utilize the Schnieder-Electric, Modicon M340 automation platform, without exception

2-2.02 Removable Memory Card. The PLC shall utilize an 8MB SD memory card to backup all application files including programs, symbols, and constants. The memory card shall also be used to activate the standard web server and to be used as data storage for data organized in a file system. PLC that rely on battery backup to retain memory will not be accepted.

2-2.03. Diagnostics. The processor shall utilize self-monitoring diagnostic techniques. Easily visible LEDs shall indicate "run" and "err" status as well as memory, input/output, and communication error conditions. Diagnostic codes shall also be available through the programming device to facilitate troubleshooting.

2-2.04. Programming Port. The processor shall include a USB programming port that is available for programming and monitoring on-line after the system is fully functional. Removal or disruption of network communications, remote I/O communications, or HMIs to permit programming and monitoring will not be acceptable.

2-2.05. Communications. The processor shall be programmed to operate autonomously, regardless of communications status with other units.

2-2.06. Environment. The processor shall be suitable for operation in the environments specified in another section.

2-2.07. Programming. The processor shall be programmable using conventional relay ladder logic. The program shall be turned over to the city upon substantial completion. The programming shall include the following functions and features.

Contacts, coils, branching.

Data comparisons.

On-delay and off-delay timers.

Counters with comparators.

Floating Point Math and Logical instructions.

Master control relay.

Transitional or one-shot outputs.

Standard and user-defined data tables for digital and analog value storage.

2-2.08. Capabilities. The processor shall include the following capabilities for programming, debug of programs, and troubleshooting.

Off-line programming.

On-line status of coils and registers.

Input/output forcing.

2-2.09. Configuration. Processors shall be configured for standard rack mounting and shall be of plug-in printed circuit board construction. Each programmable logic controller shall include integral communications ports for the programming device, remote input/output, HMI device, or remote communications interfaces as required.

Programmable logic controller systems shall support the following types of input/output.

120 volt ac digital input and output.

24 volt dc digital input and output.

4-20 mA dc analog input and output.

2-2.10.. Input/Output Hardware. Input/output hardware shall be supplied in standard modules of 4, 8, 16, or 32 points each for assembly in local and remote input/output enclosures.

All input/output hardware shall be entirely contained within the PLC enclosure.

Programmable logic controllers having fixed, non-removable input/output hardware are notacceptable.

All digital input/output hardware shall include isolation against surges of at least 1500 volts. All output hardware connected to inductive loads shall be supplied with surge suppression devices as required and recommended by the PLC manufacturer to prevent damage to output hardware. Combination input/output modules will be acceptable if they meet all of the requirements in the following subparagraphs.

2-2.11. Wiring Terminals. All input/output modules shall utilize easily removable plug-in or hinged field wiring terminals to allow removal of modules without disconnecting individual wires.

2-2.12. I/O Circuit Power Supply. Outputs for motor driven equipment will typically be powered from the driven equipment. Digital outputs for miscellaneous equipment shall be powered either from the controlled equipment or the PLC enclosure as indicated on the drawings or as coordinated with the controlled equipment supplier. Outputs that control process equipment specified under other sections or provided under other contracts shall be fully isolated or shall operate relay-type digital output modules or interposing relays in the PLC cabinet.

2-2.13. Digital Input Modules. Digital input modules shall sense voltages between 100 and 130 volts ac or 20 and 28 volts dc and shall have LED indicators for each point to display the status of the field contact. Each input module shall be suitable for being connected to a separate voltage source and return. Return voltage may be common to the entire input module. Digital input modules shall provide complete electrical isolation between individual inputs.

2-2.14. Digital Output Modules. Digital output modules shall control voltages from 100 and 130volts ac or 20 and 28 volts dc and shall be rated at least 1 ampere. Outputs shall be individually fused and shall have LED indicators to display output status. Each digital output shall be provided with an interposing relay. Outputs shall withstand a surge of at least 80 amperes for one cycle and shall have an off-state leakage current not to exceed 2.0 mA.

2-2.15. Analog Input Modules. Analog input modules shall accept linear 4-20 mA dc signals from field transmitters. Input circuitry shall be floating differential type designed to prevent loop grounding. Analog to digital conversion accuracy shall be at least 12 bit (0-4095 count) resolution. Where analog input signals are grounded outside of the PLC enclosure, isolation shall be provided for the associated analog input point either on the analog input module or through an I/I signal isolator provided in the PLC enclosure.

2-2.16. Analog Output Modules. Analog output modules shall transmit linear 4-20 mA dc signals to field devices. Loop power for all analog outputs shall be provided by regulated power supplies in each input/output enclosure and shall be

capable of driving a 0 to 600 ohm load. Digital to analog conversion accuracy shall be at least 12 bit (0-4095 count) resolution.

2-2.17. Panel Terminations. All PLC input/output signals for field connections shall be terminated through panel enclosure terminal strips. Direct connection of field wiring to the I/O module terminals is not acceptable.

2-3. COMMUNICATIONS. Each programmable controller system shall be furnished complete with communication hardware modules for local input/output hardware, other programmable controllers, and the plant control system host computers.

Communication hardware shall be compatible with the cable, data highway, fiber optic, or plant control system communication media.

2-3.01. Addressability. Each programmable logic controller shall be individually addressable so that only the selected controller responds when queried. At least 64 distinct network addresses shall be available. IP addressing shall be used. Designation of a controller's network address may be either a software or hardware function.

2-3.02. Communications Hardware. System Supplier shall provide all necessary communications hardware. Hardware shall be included for, but not be limited to, remote I/O, host computer, fiber optics, and Ethernet switches and radio.

2-3.02.01. PLC to PLC Communications Hardware. Each PLC shall communicate to other PLCs over the Ethernet TCP/IP communications network. System Supplier shall include all enclosure mounted communications modules required for a complete working system.

2-3.02.02. PLC to Remote Communications Hardware. The master PLC shall communicate with the remote PLC rack over the Ethernet TCP/IP communications network. System Supplier shall include all enclosure mounted communications modules required for a complete working system.

2-3.02.03. PLC to Host Communications Hardware. Each PLC shall communicate to the host computer over a Ethernet TCP/IP communications network. System Supplier shall include all enclosure mounted communications modules required for a complete working system.

2-3.03. Communications Media. System Supplier shall provide all necessary cabling for the PLC communications network within the PLC enclosure. Communications media external to the PLC enclosure shall be provided by the installations contractor. Communications cables shall meet the requirements of the manufacturers of the PLCs and communications modules.

2-4. PROGRAMMING SOFTWARE. UV System Supplier shall own one licensed copy of PLC programming software necessary to complete the programming. The software shall be suitable for running on a laptop computer running Windows XP operating system software. The programming software shall include all necessary device drivers and add-on software packages.

2-4.01. Standard Product. The programming software shall be personal computer based and a standard product of the PLC manufacturer. Manufactures propriety software program will not be accepted. Modicon Unity, no substitute.

2-4.02. PLC Simulation. The programming software shall include a PLC simulation feature that allows the program logic of a single PLC to be tested and debugged entirely in the programming device without the PLC.

2-4.03. Programming Software Features. The programming software shall allow off-line development of all PLC-related programming, including user annotation of the program, and creation and printing of application programs and I/O cross-reference lists. Special programming tasks originally provided by System Supplier shall also be included.

On-line features shall include IEC-1311 standards program modification, ladder-logic modification, program language modification, monitoring of real-time ladder-logic execution, monitoring of program execution, monitoring and manipulation of timer and counter preset and present values, monitoring and forcing of physical I/O, and monitoring and manipulation of analog (register) and bit (binary) data table values. PLC and I/O hardware diagnostic and status information shall be accessible using the software in on-line mode.

2-5. SYSTEM ENCLOSURES. Programmable logic controllers and input/output hardware shall be housed in shop-assembled panels as indicated on the drawings and as described in the Panels, Consoles, and Appurtenances section

2-5.01. Operator Interface Terminals. Operator interface terminals (OIT) shall be microprocessor-based flat panel type. The unit shall have data entry capabilities and shall include a password security function. The unit shall be connected to the PLC and shall display status, alarm, and diagnostic information. The unit shall provide a nominal diagonal display area dimension of 12", with a minimum resolution of 800x600, 18 bit color, and a luminance of 300 cd/m^2. The OIT shall be furnished with a minimum of 8 MB of flash memory and 8 MB of system memory. The operator interface unit shall be provided with an Ethernet port for communications, and one serial RS-232 or RS-485 port for programming. The OIT shall be rated NEMA 4X, suitable for panel face.

Terminals shall be powered from 120 V ac, 60 Hz, single phase. Terminals shall be suitable for ambient temperatures of +32 to +130°F and a relative humidity of 5 to 95 percent.
One licensed copy of the OIT software used to create the screens shall be turned over to the Owner upon successful startup and commissioning of the system.

The operator interface unit shall be Modicon Magellis, or equal.

OIT shall provide graphic screens that shall be used by the operators to access all functions and setpoints necessary for comprehensive control. The Manufacturer shall be responsible for developing and configuring the custom graphic displays. Each piece of major process equipment that is monitored and controlled by the control system shall be displayed on the graphic screens. Graphic screens shall be representations of the equipment and piping. The screens must accurately show all devices and equipment that is part of the control loops. The manufacturer shall use the configuration standards and conventions to be established by direct coordination with the Owner that shall describe and define such items as proposed graphic display process line colors/representations; color standards for "on", "off", "opened", "closed", and "alarm" conditions; alarm handling conventions; how items will be selected for control; methods for navigation between displays; address usage/naming conventions; and security setup. Proposed displays shall be submitted to the Engineer and Owner for approval.

2-5.02. Industrial Ethernet Switches. Industrial rated Ethernet switches shall be provided to allow Ethernet communication between the PLC, OIT, and Plant Control System.

2-5.02.01. Acceptable Manufactures. Industrial Ethernet switches shall be manufactured by Phoenix Contact, model FLSwitch LM 4TX/2FX; GarrettCom Magnum 6K Series; Moxa 508A series; N-Tron 708FX; or equal.

2-5.02.02. Capabilities. Each Ethernet switch shall include the following functionality:

a. Ports:Switch shall support the quantity of 10/100BaseTX ports and 100BaseFX fiber ports to meet the functionality indicated on the drawings, with a minimum of 20% spare auto-negotiating 10/100Base-T, RJ-45 ports, and two multimode fiber uplink ports. A minimum of four UTP ports shall be provided.

b. Each switch connection shall automatically sense the network speed of the devices to which it is connected.

c. Capable of ring-based media redundancy with 30 ms recovery time.

d. Path Redundancy: IEEE 802.1w Rapid Spanning Tree Protocol.

e. Prioritization: IEEE 802.1p QoS Support.

f. Network Segregation: Port VLAN.

g. Management: SNMPv3 and Browser-based management shall be supported.

h. IGMP snooping supported.

i. LED indication of the link activity for each port.

j. Environmental: Suitable for installation in industrial environments. Operating Temperature Range: 0 to 60C. Optional -40 to 60C rating availability.

k. Redundant 24 VDC power supply inputs

l. Conformal coating option for use in hazardous environments.

m. Mounting: DIN-rail mounted suitable for panel installation.

n. All necessary memory upgrades, software feature sets, and cables needed for proper operation of these switches shall be furnished with each switch.

2-5.03. Ethernet Connectors. Ethernet wiring connectors shall be RJ-45 male modular plug connectors.

2-5.03.01. Industrial RJ45 Connectors. Industrial connectors shall be an eight position industrial connector for use in manufacturing environments. Connectors shall meet the TIA/EIA-568-B.2 standard for Cat-5e or Cat-6 requirements. The connector shall incorporate an IP67 rated seal and shall provide protection from dust and temporary immersion in water. A tethered protective cap shall be provided. The connector shall accept a non-shielded Cat-5e or Cat-6 solid twisted pair cable. Connectors shall be Panduit Industrial TX5e, or equal.

2-5.03.02. Industrial RJ45 Receptacles. Industrial receptacles shall be an eight position industrial, panel mounted pass through receptacle. Receptacles shall meet the TIA/EIA-568-B.2 standard for Cat-5e or Cat-6 requirements. The receptacle shall incorporate an IP67 rated seal and shall provide protection from dust and temporary immersion in water. A tethered protective cap shall be provided. The receptacle shall accept a non-shielded Cat-5e or Cat-6 solid twisted pair cable. Receptacles shall be Panduit Industrial TX5e, or equal.

2-5.04. Uninterruptible Power Supply. The UPS shall provide continuous, on-line power to the application. UPS shall be single phase, 120 VAC nominal input power, and 120 VAC nominal output power. UPS shall have receptacles for output power. UPS shall have the following inputs available to the PLC: UPS in Bypass, UPS Low Battery, UPS On Battery and UPS Fail.

The UPS shall be of the single conversion, line interactive type and floor mounted within the pane. Provide a floor stand if required. The UPS shall be

sized by the Seller and provide 10 minutes of backup power at 1.3 times calculated maximum load. The UPS shall have an external bypass switch. The UPS shall be an APC Smart-UPS series or Powerware 5125 series.

2-6. LEVEL INSTRUMENTS.

2-6.01. Electrode/Conductance Relay Level Switches. Electrodes shall be rigid AISI Type 316 stainless steel solid rod type with a PVC outer sheath or flexible wire suspension type with shielded stainless steel electrode tips. PVC spacers shall be provided at 4-foot intervals of electrode length. Electrode holders shall be 4-inch ANSI Class 125 flange type, to be corrosion-resistant bracket or wall-mounted type.

Electrode relays shall be dual-coil or solid-state relay type with single-pole, double-throw output contacts rated not less than 5 amperes at 120 V ac. The relay primary power shall be 120 V ac, 60 Hz, single phase. Intrinsically safe solid-state relays shall be utilized whenever the electrodes are located in a hazardous area.

Relays shall be housed in a NEMA Type 4 enclosure, to be mounted in an instrument panel or in an explosion-proof enclosure. Electrodes and conductance relays shall be manufactured by Ametek B/W Controls or Gems Sensors & Controls/Warrick Controls.

2-6.02. Ultrasonic Level Transmitters. Each ultrasonic level transmitter shall be a microprocessor-based electronic unit consisting of a sensor assembly, a signal converter/transmitter, and an interconnecting cable. The sensor shall be encapsulated in a chemical and corrosion-resistant material such as kynar or CPVC, and shall be suitable for operation over a temperature range of -20° to +150°F and a relative humidity of 10 to 100 percent. The sensor shall be compatible with the process media being measured. Sensors mounted in areas subject to freezing shall be provided with special transducers or protected against icing by heaters. Sensors mounted in direct sunlight shall be provided with sunshades.

The supplier shall coordinate the sensor mounting requirements and furnish drawings complete with dimensions and elevations.

The ultrasonic level transmitter shall have automatic compensation for changes in air temperature at the sensor location. If separate temperature sensing probes are provided, they shall be mounted with or adjacent to the ultrasonic sensor, as recommended by the manufacturer. The transmitter shall have a four-digit LCD display scaled to read in engineering units. Digit height shall be approximately 1/2 inch. The transmitter shall be designed to ignore momentary level spikes, false targets, or momentary loss-of-echo. A loss-of-echo condition shall be indicated on the transmitter unit and shall be available as an alarm contact

output. The transmitter output shall be an isolated 4-20 mA dc signal linearly proportional to the measured level range, or where indicated on the drawings or in the Instrument Device Schedule, shall be characterized to be proportional to the tank volume. Calibration parameters shall be entered through a keypad on the unit and shall be stored in nonvolatile EEPROM memory. Accuracy of the transmitted signal shall be ±0.5 percent of the level range.

A sufficient length of sensor-to-transmitter signal cable shall be furnished with the instrument to locate the sensor 25 to 200 feet from the signal converter.

For indoor installation, the signal converter electronics shall be housed in a NEMA Type 12 enclosure suitable for wall or pipestand mounting and for operating temperatures of +30° to +120°F.

The signal converter shall be of the ac-powered type. The ultrasonic level transmitter shall be Siemens "HydroRanger 200", Endress+Hauser "Prosonic", or Magnetrol "Echotel 344."

PART 3 - EXECUTION

3-1. INSTALLATION REQUIREMENTS. PLCs installation requirements are as described herein and in the UV Disinfection System General Requirements section.

Field check, testing, and training shall be as specified in the UV Disinfection System General Requirements section.

3-2. CONFIGURATION.

3-2.01. PLC Programming and Configuration. Configuration services are specified in the UV Disinfection System General Requirements section.

3-2.02. Communications Configuration. The communications shall be fully configured and installed by System Supplier.

End of Section

Section 13700P

ULTRAVIOLET DISINFECTION SYSTEM

GENERAL REQUIREMENTS

PART 1 - GENERAL

1-1. SCOPE. This section covers the general design requirements, materials, product data, startup, and commissioning for the replacement Ultraviolet (UV) disinfection system at the Arrowhead Ranch Water Reclamation Facility (ARWRF). Proprietary/Specific design requirements and performance testing requirements for approved manufacturers are located in other specification sections.

The UV System Supplier (UVSS) shall provide all information required to the Owner and Engineer for the design of the facilities associated with the supply of the UV System for the ARWRF.

It is the intent of this Specification to establish minimum equipment and quality standards for these components, and to establish a method for pre-purchasing equipment from the selected UVSS. Further details on bidding requirements are described in other sections. Upon project award the UVSS will coordinate with the Owner and Engineer to finalize the facility design with the intent of bidding the installation to a Contractor. It is the UVSS responsibility to coordinate with the successful Contractor to provide all parts, equipment, materials, and components required for a complete and functional system including all performance testing described herein. Furthermore, the UVSS will contract directly with the Owner and thus will be required to coordinate all submittals and equipment delivery directly. All warranty, service or other agreements will be negotiated directly with the Owner.

The UV system shall be an open channel, gravity flow facility utilizing horizontal or vertical, low pressure, high intensity lamps. In general, the scope of supply for the UVSS consists of the following principal components:

- UV lamp modules with quartz sleeves.
- Lamp assemblies on removable modules.
- Horizontally or vertically mounted low pressure high output (LPHO) lamps.
- Lamp assemblies.
- Automatic quartz sleeve cleaning system.
- Influent flow balance and isolation using rising stem slide gates and actuators
- Effluent level control using a downward opening weir gate and ultrasonic level sensor

- Online UV intensity detection system.
- Online UV transmittance detection system
- Power distribution centers.
- Interconnecting power and data cables between UV modules and UV power/control equipment
- System instrumentation and controls including programmable logic controller (PLC).
- Lifting harness/hooks for removal of the UV modules from the channels by overhead crane (by Contractor) for maintenance
- UV eye shields and personnel safety equipment.
- Storage rack for two UV modules.
- Isolation/Step-down Transformers.
- Power Distribution Panels, if required.
- Accessories.
- Spare parts.
- Special tools, whether specifically mentioned in this Specification or not, as required for a complete system.
- Control panel

The UVSS shall supply all accessories and appurtenances whether listed above or not that may be required for satisfactory operation of the UV disinfection system.

1-1.01. Terminology. When the phrase "as required" is stated in this section, components shall be provided as defined in this section.

1-1.02. Definitions. Terms that are used in this section are are defined as follows:

a. Ultraviolet (UV) Light – Electromagnetic radiation with a wavelength shorter than that of visible light, but longer than X-rays, in the range 10 nm to 400 nm, and energies from 3eV to 124 eV.

b. UV Dose – The total radiant energy incident from all directions onto an infinitesimally small sphere of area dA, divided by dA, for a given contact time in seconds. The unit of UV dose shall be millijoules per square centimeter (mJ/cm^2) and shall be calculated as follows:

$$D = I \cdot t$$

Where: D = UV Dose, $mW\text{-}s/cm^2$ (mJ/cm^2)
I = average intensity or irradiance, mW/cm^2
t = average exposure time, s

c. UV Transmittance (UVT) – The transmittance of UV light at a wavelength of 254 nm through water across a pathlength of 1 cm. UV transmittance shall be calculated from UV absorbance (A) at 254 nm by the following equation:

$$\text{Percent transmittance} = 100 \times 10^{-A}$$

d. Intensity or Irradiance – The total radiant power incident from all directions onto an infinitesimally small sphere of cross-sectional area dA, divided by dA. The units of intensity shall be milliwatts per square centimeter (mW/cm^2).

e. Validated Reactor – A reactor that has been validated and previously received conditional acceptance under the following regulated conditions.

- The validated flow range contains the design flow range per reactor as stated in this section.
- The validated UVT range contains the operational UV transmittance range as stated in this section.
- The validated dose range contains the operational germicidal UV dose range as stated in this section.
- Validated results based on NWRI 2003 and received Conditional Acceptance for UV Equipment by California DPH

f. Equivalent Dose – The maximum dose necessary for a full-scale UV system to achieve a level of inactivation of a specific organism equivalent to the level of inactivation for the same organism achieved in a laboratory using a collimated beam apparatus with a low pressure lamp producing UV energy at a wavelength of 254 nm to test a water sample collected at the same time.

g. Low Pressure High Output (LPHO) Lamp – A lamp with input power equal to two to three times the input power of a low pressure (LP) lamp, primarily at 254 nm, with a pressure of approximately 0.2 psi.

h. Guaranteed Life – The manufacturer's warranted life of the lamp, sleeve, ballast, and sensor in hours.

i. Expected Lamp Life – The manufacturer's estimated lamp life based on the operating conditions described in this section.

j. Prorated Start Time – The time beginning after at least 20 percent of the guaranteed life has lapsed.

k. Guaranteed Maximum Total System Energy Use – A calculated value based on UVSS data entered in the Bid Documents reflecting energy use in kilowatt-hours per year.

l. Guaranteed Maximum Head Loss – The head loss in inches of water column allowed through the UV channel with all restrictions, including fouling and influent gate and level control gate at peak flow rate.

1-2. GENERAL. The UVSS shall select and provide equipment from one of three equipment alternatives in Sections 13701 (Alternative A), 13702 (Alternative B), or 13703 (Alternative C). Equipment furnished and installed under this section and the respective alternative sections shall be fabricated, assembled, erected, placed in proper operating condition, and tested in full conformity with drawings, specifications, engineering data, instructions, and recommendations of the equipment provided by the UVSS unless exceptions are noted by the Engineer. Performance and spot-check bioassay testing requirements for equipment provided under this specification are found in Section 13704.

The design of a UV disinfection system requires considerable coordination between the Owner, Engineer, Contractor, and the UVSS. The UVSS shall provide assistance to the Engineer and Owner and provide the information needed to coordinate the design of the UV disinfection system and the ancillary equipment designed by the Engineer but not provided by the UVSS.

The UVSS shall coordinate the requirements of the concrete channels with the Engineer and Owner during design of the UV disinfection facility.

The UVSS shall provide installation instructions to the Contractor, and review the installation of the system prior to start-up and commissioning. Since the UVSS will not be under contract with the Contractor the UVSS shall coordinate as much as possible with the Owner to determine the appropriate delivery schedule for the selected Contractor. Careful coordination for all scheduling of inspection and start-up activities shall be required of the UVSS as well.

The UVSS shall be responsible for the integration of the PLC and OIT equipment provided by the UVSS and required for UV operation. The UVSS shall coordinate signal interchange requirements between the PLC and the Plant Control System (PCS) such that the PCS will be capable of monitoring all parameters within the PLC requested by the Owner. Integration of the PCS will be done by Others.

The UVSS shall assume responsibility for certifying the Contractor's satisfactory installation of the UVSS's equipment. The UVSS shall also assume responsibility for the system warranty and performance testing including validation and spot-check bioassay testing of the UV system.

All components of the UV system shall be factory tested by operating all lamps, monitoring equipment, and controls prior to shipment. The UV system supplier shall provide written certification following factory testing. This test may be witnessed by the Owner at the expense of the Owner. Systems that are not factory tested or that require extensive field assembly are not acceptable. All equipment included under this section shall be furnished by a single UV system supplier who shall have the responsibility for coordination and performance of all components of the system.

Ancillary equipment that is part of the UVSS scope of supply include the following specification sections:

- 13530 – Programmable Logic Controllers
- 15114 – Open Channel Slide Gates and Weir Gates

The successful UVSS shall provide all materials associated with each specification section and shall fully integrate each component for a complete and operational system.

1-2.01. General Equipment Stipulations. The General Equipment Stipulations shall apply to all equipment furnished under this section. If requirements differ in this specification from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

1-2.02. Power Supply. Power supply to the UV system from the existing plant power distribution system shall be 480 volt, 3 phase, 4 wire, 60 hertz. The UVSS shall provide isolation/step-down transformers, if required as specified in this section to the utilization voltage as required by the system furnished.

Power supply to the UV cleaning system if not integrated into the UV module shall be a separate 480 volt, 3 phase, 4 wire or 120/240 volt, 1 phase if required. Any isolation/step-down transformers required for the cleaning system shall be the responsibility of the UVSS.

Power supply to the UV system main control panel shall be 120 volt, 1 phase, 60 hertz.

The UVSS shall be responsible for providing a dedicated Power Panel for power service to the UV system equipment. All circuits necessary to support the UV system shall be derived from this Power Panel. The Power Panel will be installed by the Contractor with direction from the UVSS, Engineer and as shown on the drawings. The UVSS Power Panel will be supplied with one 480 volt, 3 phase, 4 wire, 60 Hz circuit from the existing plant. All necessary transformation equipment to convert this voltage to utilization voltages shall be provided by the UVSS and installed by the Contractor if required. Any additional electrical

distribution equipment necessary to support the UV system shall be provided by the UVSS and installed by the Contractor. Coordination with the Contractor and Engineer is necessary and expected.

1-2.03. Anchor Bolts. All anchor bolts, nuts, and washers shall be Type 316 stainless steel, sized (minimum 3/4 inch), and provided by the Contractor and approved by UVSS and shall comply with the anchor bolts and expansion anchors section. Tie rod connections will not be acceptable.

Anchor bolts shall be accurately located as required for the equipment furnished.

1-2.04. Fasteners. All bolts, nuts, washers, and other fasteners shall be Type 316 stainless steel and shall be provided by the Contractor and approved by the UVSS. Bolts and nuts shall be Type 316 stainless steel conforming to ASTM A193, Grade B8M for bolts and ASTM A194, Grade 8M for nuts. The nuts shall have a hardness that is lower than that of the bolts and washers by a difference of 50 Brinnell hardness to prevent galling during installation. Anti-seize compound shall be applied to all threads prior to connection.

1-2.05. Edge Grinding. Sharp corners of cut or sheared edges shall be dulled by at least one pass of a power grinder.

1-2.06. Surface Preparation. All ferrous metal surfaces, except stainless steel, shall be shop cleaned by sandblasting or equivalent, conforming to the UVSS recommendations. All mill scale, rust, and contaminants shall be removed before shop primer is applied.

1-2.07. Shop Painting. All ferrous metal surfaces, except stainless steel, shall be shop painted in accordance with the General Equipment Stipulations. All conditions in the General Equipment Stipulation Section for shop painting shall apply.

1-2.08. Stainless Steel Cleaning. All stainless steel shall be cleaned, chemically descaled (pickled), and passivated at the mill in accordance with ASTM A380 before being shipped. Pickling shall produce a modest etch and shall remove all embedded iron and heat tint. All pickled surfaces damaged during fabrication, including welded areas, shall be repickled or passivated in accordance with ASTM A380 as required to remove all traces of iron contamination and heat tint. Vat dipping, paste, and other electrical/liquid techniques will be acceptable forms of passivation as acceptable to the Engineer. All stainless steel surfaces shall be adequately protected during fabrication, shipping, handling, and installation to prevent contamination by contact with iron or carbon steel objects or surfaces. Blast cleaning of stainless steel will not be acceptable. Any field welds or repairs may be cleaned and passivated using hand powered tools equipped with clean stainless steel brushes and grindery.

Alternative techniques during the manufacturing process to prevent contamination of stainless steel may be acceptable to the Engineer provided that the intent of the paragraph above is met. Manufacturer shall submit a certification stating that the alternative techniques will meet the requirements described herein.

1-3. QUALITY ASSURANCE

1-3.01. Qualification Requirements. The UVSS shall demonstrate the validated dose required in this specification can be met under de-rated conditions using End of Lamp Life (EOLL) and Fouling Factors (FF) specified herein. A statement by the UVSS listing any deviations or exceptions taken to these Specifications shall be provided with the UV system supplier's bid proposal. It shall be at the City and Engineer's final discretion regarding the acceptance or denial of any deviations or exceptions taken to the project specifications. Unacceptable deviations from the specifications may be just cause for the rejection of the proposed equipment.

The UV disinfection system supplied shall be capable of disinfecting effluent to meet the water quality requirements listed in the design requirements section.

The UVSS shall be regularly engaged in the manufacture of UV systems with a proven track record of at least five LPHO or Low Pressure High Intensity (LPHI) systems of 9 mgd or greater meeting high level disinfection installed and operating in the United States. One of the five facilities must be located in Arizona, providing Class A+ effluent quality.

The UVSS shall have a minimum of 5 years experience manufacturing in North America and delivering equipment identical to the proposed system, as indicated in the design requirements, including major system components such as lamps, sleeves, and ballasts.

The UVSS shall provide documented conditional acceptance by the California Department of Public Health (Title 22).

The UVSS shall provide documentation that all Federal "Buy American" provisions of this contract can be met as defined in the "Instructions to Bidders" section.

Existing systems that are listed as references shall have equipment identical to the proposed system including lamps, sleeves and ballasts.

All equipment furnished under this specification shall be new and shall be the standard product of a supplier who is regularly engaged in the supply of the equipment to be furnished.

Documentation of all validation data used to provide the design for this project shall be submitted with the bid proposal. If additional validation data is required for this project it shall be at the UVSS cost.

1-3.02. Performance Requirements. The UV disinfection system provided shall produce an effluent conforming to the effluent standards defined in the design requirements section of this specification. This performance shall be guaranteed in writing by the UVSS.

Harmonic distortion data shall be submitted and shall be in accordance with IEEE 519-1992 Tables 10.1, 10.2, and 10.3 Data shall be submitted showing compliance with this requirement. Power factor shall be 96 percent or greater.

Harmonic distortion testing shall be conducted to verify the effects of harmonics on the plant power distribution system. Tests shall be performed at the primary and secondary points of common coupling and shall include phase-to-phase, phase-to-neutral and neutral-to-ground measurements. THD and TDD results shall be limited to those identified in IEEE 519. Graphs of harmonic spectra and current waveforms shall be submitted for review. Harmonic mitigation equipment necessary to elevate UV system into compliance with IEEE 519 shall be provided by UVSS and installed by Contractor. All associated installation costs, programming costs and calibration costs shall be the responsibility of the UVSS.

Harmonic distortion testing shall be performed by an Engineer approved 3rd party testing company secured by the UVSS. Engineer shall be notified at a minimum 3 weeks in advance to schedule witness of testing.

The UV validated dose produced by the system shall not be less than as specified in the design requirements as verified by a spot-check bioassay conducted according to procedures approved by the State (if required) and Engineer.

The UVSS, in conjunction with the Contractor shall be responsible for establishing control of the UV disinfection system. The PLC equipment I/O, OIT equipment and control programming required to make a full and operating system shall be provided by the UVSS. The UVSS shall supply a complete list of available software I/O from the UV PLC for integration into the plant PCS by Others.

The UVSS shall supply calculations and drawings for the System and any other performance data specifically required by regulatory agencies for acceptance of the technology.

1-4. SUBMITTALS. The UVSS shall submit for review, engineering data, including the values provided for headloss, power consumption, and disinfection ability. This data will be verified during the performance testing of the system and prior to the acceptance of the equipment by the Owner. Any exceptions or deviations to these specifications shall be listed and fully described on the first page in the submittal.

1-4.01 Engineering Data. Complete installation drawings including channel geometry and dimensional requirements, together with detailed specifications and data covering materials, parts, devices, and accessories forming a part of the equipment furnished, shall be submitted for review. Data and specifications shall include, but shall not be limited to, the following:

a. Exceptions and/or deviations from the specifications.

b. Complete description in sufficient detail to permit an item-by-item comparison with the Specification.

c. Dimensions and installation requirements of all required elements.

d. P&IDs of the System including equipment supplied by UVSS and equipment provided by others that will interface with the system. P&IDs shall include each control or monitoring device and indicate all hard wired interlocks plus all inputs/outputs to the programmable logic controller. The UVSS is responsible for establishing the P&ID tag numbering for the units and the system in full coordination with the Engineer and Owner and shall follow the Owner's established tag numbering scheme described in the specification.

e. Descriptive information, including catalog cuts and UV system suppliers' specifications for major components.

f. Bill of Materials: Provide a bill of materials after approved shop drawings for all tagged devices and components supplied with the UV System including component original part numbers identifying each furnished component. Manufacturer's literature, illustrations, specifications, weights, and engineering data for project engineered equipment including dimensions, materials, sizes, and performance data. For all tagged devices supplied, the UVSS shall develop a "Cross Reference Schedule" that matches the Tag to the appropriate equipment manual. The equipment schedule shall include the pertinent information associated with the equipment including tag number, description, functional name location, component equipment model, part number, size, materials, accessories and range. The Cross-Reference Schedule shall be provided in the form of a Microsoft Excel (.XLS) spreadsheet in electronic format.

g. UV System Control Cabinet drawings and equipment cut sheets. Control Cabinet drawings shall include cover sheet, complete sheet list, bill of materials, front and interior elevations, and detail schematics. Front elevations shall include OIT and other door mounted devices clearly identified. Interior elevation shall include all devices included in the panel including but not limited to PLC layout, terminal blocks, wireways, relays, circuit breakers, power supplies, and UPS. Detail schematics shall include terminal blocks, wire numbering, device labels, all PLC connections, differentiation between internal and external wiring connections, and clear identification of UVSS responsibility and Installation contractor responsibility. Equipment cut sheets shall be provided for every component in the control cabinet with part numbers and options clearly marked.

h. Complete PLC input/output list of hard wired signals including description of signal, tag number if applicable, and PLC rack/slot/point information.

i. Complete PLC register listing of all internal points available for integration into the Owner's Plant Control System for monitoring purposes only. List shall include register number(s), description of point, and tag number if applicable. List shall include all points displayed on the UVSS supplied OIT. This listing shall be deferred until after final approval of UV system submittal but prior to equipment shipping. Updates to this list shall be provided throughout the project as PLC program updates are made.

j. Electrical schematics, power and control one-line diagrams, plan layouts, power panel schedule, and load summary. Electrical schematics shall provide details for all field-wiring requirements between the UV system control panels and externally mounted equipment. Power and control one-lines shall include all conduit and cable requirements between equipment provided by UVSS and required interconnections with equipment not provided by the UVSS. Plan layouts shall clearly identify equipment locations clearly on plan layouts. The power panel schedule shall include all relevant power panel information with load summary information for the UVSS Power Panel.

k. Detailed narrative information on how the actual UV control system will operate. Narrative shall include both automatic and manual control operational sequences.

l. Listing of 5 full-scale multi-channel installation references in North America, who are users of similar systems with similar hydraulic capacity high level disinfection using the lamp technology being provided, which are designed, assembled, and furnished by the UVSS. These

systems must have been in operation sufficient time (36 months) to determine replacement frequency for lamps, ballasts, quartz sleeves, and wipers. Contact names, phone numbers, addresses, and brief project descriptions shall be included.

m. Documentation of a validation report following NWRI guidelines prepared by an independent testing laboratory or field testing completed on similar to the proposed equipment operated in an activated sludge treatment facility. This documentation shall be the most recent report on the same type of equipment, preferably within the past 3 years. When bioassay report is over three years old, spot-check bio assay data shall be submitted to confirm the results of the original report. This spot-check report shall verify the maximum flow rate per lamp that will result in the design delivered UV validated dosage. The spot-check bioassay test shall have been based on MS2 phage, to ensure that delivered dosage can be accurately provided by the equipment being proposed at the specific application for the UV equipment described in this specification. All validation results shall be certified by independent third party and conditionally approved by the California Department of Public Health. Proof of acceptance letter by government agency shall be included with the proposal. The intent of this requirement to allow the UVSS to provide documentation on the fouling factor and end of lamp life factor either from regulatory or third party. Typically what is submitted is either a letter from a regulatory agency or cover sheet from a Third party report indicating what has been submitted to a regulatory agency for approval. The manufacturer does not have to provide the entire report which would document end of lamp life factor and fouling factor. The UVSS is responsible for providing sufficient information to the Engineer to ensure that the fouling factor and end of lamp life factors in the specification can be achieved.

n. Dosage calculations from validation equations using a percent transmittance at UV_{254} indicated in the design requirements, with end of lamp life output and fouling factors specified in the design requirements.

o. Calculations showing power draw from system to achieve disinfection conditions described in this specification The UV system supplier shall state the power per lamp (including ballast loss and cooling) and the system peak power consumption (including ballast loss), for both new lamps and end of lamp life.

m. Certified test results for power (kW), power factor, and apparent power (kVA) for the entire system. Actual power draw data from the facilities of similar design for high level disinfection shall be submitted to verify information provided. Representative harmonic analysis report for both

voltage and current at the point of common coupling as defined at the input terminals to the power unit. The testing shall be completed on the specific type unit provided for this project. This shall be done for the peak hour, existing average day, future average day, and minimum day flow conditions.

n. Representative hydraulic calculations demonstrating compliance with the required hydraulic characteristics, including head loss calculations through the channel with all restrictions, weirs, and controls factored in. This shall be done for the minimum, peak day and average day flow conditions

o. The quartz sleeve manufacturer shall state and submit the minimum UV_{254} transmission of the quartz sleeves, and their guaranteed useful life.

p. Lamp output certification. Complete UV lamp and ballast output report prepared by an independent testing laboratory within the past 12 months or most recent certification if the lamp technology being submitted has not changed. This report shall verify the output of the lamp and ballast at various operating conditions.

q. Guaranteed operating life of lamps in hours and ballasts in years.

r. Structural design calculations for fabricated assemblies signed and sealed by Registered Professional Engineer (Structural) currently licensed in the same state as the final installation if required by the location of the installation. UVSS shall be required to coordinate required structural design documents with Contractor. Calculations shall include seismic considerations for the location of the installation.

s. Certification that the cost of replacement lamps, ballasts, quartz sleeves and other cosumables are guaranteed for a minimum of 5 years from the date of acceptance after performance testing. During these 5 years, the price shall be adjusted annually by the Producer Price Index – Industrial Commodities (where the base is 1982 = 100) published by the United States Department of Labor, Bureau of Labor Statistics, applicable on the anniversary of the date of UV system acceptance.

t. Spot-check bioassay testing protocols for the new UV system provided under this project. These protocols should include procedures for influent and effluent mixing verification. This protocol should include a review of feed location for the transmittance inhibition chemical as well as the challenge microorganism (MS2). Sampling locations and protocols shall also be identified and discussed in the testing protocol. Further details on testing and protocol requirements are specified in Section 13704.

u. A suggested service contract following the guidelines as specified in this and other Sections.

Values submitted for microbial reduction, head loss, and power consumption will be verified as specified in Section 13704 during the performance testing and commissioning of the equipment and prior to acceptance of the equipment by the Owner. Any exceptions or deviations to these Specifications shall be listed and fully described in the Bid Proposal. Exceptions or deviations must be substantiated and documented and are subject to approval by the Engineer and Owner..

1-4.02. Operation and Maintenance Data and Manuals. Adequate operation and maintenance information shall be supplied. Operation and maintenance manuals shall be submitted based on the requirements of Section 01300, Installation, Operation, and Maintenance Manuals. Refer to the submittals Section 01300 for additional information which shall be included and the format that shall be followed for the operation and maintenance manuals. Equipment designations shall correspond to those indicated on the Drawings.
Operation and maintenance manuals shall include but not limited to the following:

a. General information as required by the UV system supplier.

b. Contact information.

c. Operation information including equipment function, normal operating characteristics, and limiting conditions. Operating instructions for start-up, routine and normal operation, regulation and control, shutdown, and emergency conditions. Information on operation of system during high temperatures (+110 F) and high humidity (90 percent)

d. Assembly, installation, alignment, adjustment, and checking instructions. Outline, cross-section, and assembly Drawings; engineering data; and wiring diagrams. Part lists and predicted life of parts subject to wear.

e. Recommended routine and preventive maintenance schedules. Schedule shall be a chart listing daily, weekly, monthly, and yearly activities, and include other activities as required to maintain equipment.

f. Lubrication and maintenance instructions, where applicable.

g. Step-by-step procedure for cleaning lamps, sensors, and reactors, including the volume of cleaning chemical required to clean one reactor and expected cleaning frequency given the water quality constituents.

h Guide to troubleshooting This should include detailed instruction on troubleshooting, process, mechanical, electrical and instrumentation issues, .

i. Spare parts, where applicable.

j. Accessories, where applicable.

k Test data and performance curves, where applicable.

The operation and maintenance manuals shall be in addition to any instructions or parts lists packed with or attached to the equipment when delivered. Operations and maintenance manual shall be provided in both written and a searchable electronic file. Preliminary O&M Manuals shall be provided as part of the shop drawing process.

1-4.03. Samples. Samples for performance testing shall be collected and analyzed after installation, as described in this specification and in other specification sections. Sampling shall be performed by the UVSS or its representative. All costs associated with sampling and testing are the responsibility of the UVSS.

1-4.04. Test Reports. Five copies of all test reports shall be prepared and submitted after installation and approved by the Engineer, as described in the Field Test section. UVSS shall also provide an electronic .pdf copy of preliminary and final test reports.

1-5. SPARE PARTS. The following spare parts shall be furnished in substantial wooden boxes with identifying labels and delivered with the system as listed below.

Spare Parts, if required by UVSS	
UV germicidal lamps, % of total supplied	10
Lamp ballasts, electronic, % of total supplied	1
UV modules (completely wired and ready for installation)	1
Lamp sleeves or quartz jackets	4
Set of gland nuts, washers, O-rings, and seals, % of total supplied	10
UV intensity monitor sensor with circuit board,	1
Lamp control logic circuit boards	1
Control system software program	1

Cables for laptop connection	1

Spare parts shall be suitably packaged in accordance with the General Equipment Stipulations, with labels indicating the contents of each package. Spare parts shall be delivered to Owner as directed. All spare parts shall be in waterproof packages suitable for export service, labeled with the description and part numbers. Each item or set of parts expected to be installed at one time shall be in an individual package.

If any of the above spare parts are used during the installation process, they shall be replaced by the UVSS at no cost to the Owner.

In addition to the above noted spare parts, any special tools required to facilitate maintenance of any component of the UV system shall also be furnished.

1-6. WARRANTY. The equipment furnished under this section shall be free from defects in materials and workmanship, including damages that may occur during shipping, for a period of 1 year from the date of substantial completion. Substantial completion shall not be issued until after performance and validation testing has been concluded and approved by Owner and Engineer.

Lamps shall be warranted for a guaranteed lamp life to produce a validated dose as indicated by UVSS in the Bid Form regardless of delivered dose as described by the UVSS on the approved test organism. If 20 percent of the lamps installed as part of this contract fail before the guaranteed lamp life, the UVSS shall replace all lamps and provide installation labor within 30 days after written notification from the Owner, at no additional cost to the Owner based on a prorated cost determined by the actual operating hours of the lamp. The full replacement of lamps does not apply if either the lamp failures can be shown that they are at no fault of the UVSS or if they are a result of the system not being operated in accordance with the UVSS O&M manual.

Ballasts shall be warranted for a guaranteed ballast life of 5 years. Ballasts shall be designed for the service conditions for which they are provided and shall be unconditionally warranted for the guaranteed ballast life regardless of the power output and operating hours. If 20 percent of the ballasts installed as part of this contract fail before the guaranteed life, the UVSS shall replace and provide installation labor forall ballasts within 30 days after written notification from the Owner, at no additional cost to the Owner based on a prorated cost determined by the actual operating hours of the ballast. The full replacement of ballasts does not apply if either the ballast failures can be shown that they are at no fault of the UVSS or if they are a result of the system not being operated in accordance with the UVSS O&M manual.

Quartz sleeves shall be designed for the service conditions for which they are provided and shall be warranted for a minimum of 5 years. If 20 percent of the quartz sleeves fail to maintain a minimum transparency factor of 0.90 during the 5 year period, the UV system supplier shall replace all quartz sleeves within 30 days after written notification from the Owner, at no additional cost to the Owner. UVSS will be required to test a representative number of quartz sleeves that have been in operation each year to determine the transparency factor on site. All labor shall be provided by the UVSS. The full replacement of quartz sleeves does not apply if the failures can be shown that they are no fault of the manufacturer or if they are a result of the system not being operated in accordance with the UVSS O&M manual

The warranty for lamps, ballasts, and quartz sleeves shall include all parts and freight for replacement during the warranty period. A written warranty acceptable to Engineer and Owner shall be provided.

1-7. UV SYSTEM SUPPLIER'S SERVICES. The field representative shall report to the site at the times designated by the Owner, Contractor, and UVSS, provided not less than 15 days' notice is given to the UVSS. The UVSS shall provide site visit time for witness of equipment installation, equipment installation certification, startup, and instruction. These requirements are in addition to the UVSS responsibilities during performance testing as specified herein. The UVSS shall be responsible for additional services and travel expenses necessary due to defective installation, materials, or equipment provided or performed by UVSS.

Duties of the UVSS field representative during installation shall include the following:

Instructing and guiding the proper methods and procedures on all technical phases of UV equipment installation.

Inspecting and indicating approval or disapproval of the installation as it progresses.

Reporting observations in writing with copies to the Owner through the Engineer.

Determining when equipment is ready for startup and operational checks.

Troubleshooting issues with any equipment or control panels associated with the UVSS scope of supply.

All startup adjustments and testing of equipment shall be performed in the presence of the Engineer and the UVSS field representative, unless otherwise agreed and documented in writing, and such operations shall be in accordance

with the UVSS instructions. No startup or testing shall be undertaken without the UVSS approval.

It shall be the duty of the UVSS field representative, during the process of installation, startup, testing, and such other times as may be required, to instruct the Owner's designated personnel in the proper operation and maintenance of the equipment. A formal training session shall be required to fully integrate Owner staff with the operation of the system.

The UVSS shall furnish to the Owner, through the Engineer, a written report certifying that the equipment (1) has been properly installed, (2) is in accurate alignment, and (3) is free from any undue stress imposed by anchor bolts or any other attachment.

1-8. 5-YEAR SERVICE AGREEMENT. The UVSS shall supply a suggested service contract for the Owner's review. The final agreement shall not be entered into until the equipment has been manufactured and installed. Pricing as indicated in the Bid Form shall be included and based on the requirements outlined in this Section. Price indicated in the Bid Form shall be the maximum possible cost to the Owner for ongoing service. The total duration of the service agreement shall be 5 years from the date of substantial completion.

The service agreement shall include two site visits annually for duration of five working days. Visits shall be pre-scheduled with the Owner. Each visit shall consist of the following components:

1. Visual Inspection
    a. Review site records, trended data and parameter settings
    b. Recording of operational status
    c. Review condition of quartz sleeves, electrical cables, intensity sensors and UVT probe
2. Replacement of Defective or Worn Components
    a. Lamps
    b. Ballasts
    c. Wiper Rings
3. Confirm Instrumentation Functionality and Calibration
    a. Software/PLC
    b. UVT Probe
    c. Intensity Sensors
    d. Level/Flow Ultransonic Probes
    e. Signal Isolators
4. Functional Testing
    a. Software/PLC
    b. UV Lamps/Ballasts
    c. Check Operation in Manual and Auto Modes

d. Wiping System
e. Safety Interlocks
f. Local Operation

5. Documentation
   a. O&M Updates
   b. PLC Logic Updates
   c. Equipment, Electrical and Mechanical Drawings
   d. Recommended Spare Parts List

All components requiring replacement that are within the warranty specified in this and other sections shall be replaced at the UVSS's expense. All other components will be installed by the Owner under the direction of the field service technician. Additionally, the field service representative shall review the quantity of spare parts maintained in the Owner's inventory and recommend additions as necessary.

The UVSS's field service representative shall be properly trained in the maintenance of the selected UV system and shall be sufficiently qualified to safely perform all maintenance activities including the physical replacement of components. The field service representative shall provide all necessary safety equipment for inspection and/or maintenance of the system. The Owner will make the necessary personnel available to provide sufficient access to the equipment during site visits.

PART 2 - PRODUCTS

2-1. SERVICE CONDITIONS. The UV disinfection modules shall be installed in the concrete channels following the tertiary filters inside a building. The UV system will be used to disinfect wastewater which has undergone screening, grit removal, , activated sludge treatment, final clarification and tertiary filtration. UV disinfection will be the final process prior discharge from the plant.

2-2. PERFORMANCE AND DESIGN REQUIREMENTS. The UV equipment shall be designed for the performance requirements indicated herein. The equipment shall be designed for suitable installation in concrete channels with dimensions as required by the selected UV equipment.

The end of lamp life UV dose produced by the system shall not be less than value indicated in the design requirements. The guaranteed lamp life shall be as indicated by UVSS in the Bid Form. System performanceshall be based on an effluent with UV transmission as indicated in the design requirements at 253.7 nm at peak flow with fouled sleeves at the end of lamp life.

2-2.01. Design Requirements. The equipment design requirements shall be as follows:

Parameter	Value
Peak Q, mgd	9.0
Current Average Q, mgd	3.0
Future Average Q, mgd	4.5
Minimum Q, mgd	2.0
Number of Channels	2
UV Transmittance (253.7 nm), %	65
Min. UV validated dosage, at design conditions, after minimum number of hours based on MS2 phage, mJ/cm^2 and based on NWRI 2003 protocol	120
Maximum Lamp Output at EOLL, 9,000 hours, **Bid Alternative A**	.95
Maximum Fouling factor, 9,000 hours, **Bid Alternative A**	.90
Maximum Lamp Output at EOLL, 9,000 hours, **Bid Alternative B**	.88
Maximum Fouling factor, 9,000 hours, Bid **Alternative B**	.86
Maximum Lamp Output at EOLL, 9,000 hours, **Bid Alternative C**	.90
Maximum Fouling factor, 9,000 hours, Bid **Alternative C**	.75
Maximum Effluent. CBOD	5
Influent UV System fecal coliform, cfu/100 mL	>1600
Eff. fecal coliform, cfu/100 mL Single Sample Maximum 4 of 7 Samples	 23 ND
Effluent water temperture, Deg F	50 - 80
Effluent TSS, mg/L	5
Maximum Effluent Turbidity, NTU	4
Average Effluent Turbidity, NTU	0.75
Bioassay Required	Yes
Maximum allowable head loss across system at peak flow with fouling including influent gate and level control gate	20"
Level control assembly	Automatic downward opening weir gate with level

	sensor

2-3. EQUIPMENT. The following paragraphs provide equipment design construction general to all UVSS Bid Alternatives. There are separate sections specific to each approved lamp technology and can be found in Section 13701P (Bid Alternative A), Section 13702P (Bid Alternative B), and Section 13703P (Bid Alternative C). The UVSS shall meet all requirements in the general UV equipment specification Section 13700P in addition to the requirements specified in the other sections including Performance Testing as specified in Section 13704P. The UVSS must meet all of the requirements for one of the three alternatives to be considered for selection.

2-3.01 General. The following paragraphs provide equipment design construction general to all equipment provided by the UVSS.

The UV system design of shall allow for maintenance without requiring any channel to be shutdown or bypassed. The system shall be able to continue providing disinfection while replacing UV lamps, quartz sleeves, ballasts, and during cleaning of the UV lamps and quartz sleeves. No tools or special equipment shall be required for module removal other than that described in this specification. All wetted parts shall be Type 304 or 316 stainless steel, quartz glass, teflon or plastics not susceptible to UV or chemical degradation, including oxidants.

All metal components above the water surface shall be Type 304 or Type 316 stainless steel. All wiring exposed to UV light shall be teflon coated or other suitable UV-resistant material and warranted for 5 years (parts and labor). All material exposed to UV light shall be Type 316 stainless steel, Type 214 quartz, teflon, or other suitable material approved by Engineer.

2-3.01.01. General UV Lamps Requirements. The UV system shall utilize LPHO, mercury amalgam design lamps capable of variable control of power output from a minimum range of 60 to 100 percent. Each lamp shall be protected from contact with the fluid by a quartz sleeve. Lamp filaments shall be significantly rugged to withstand shock and vibration. Lamps shall be rated to produce zero levels of ozone. Lamp bases shall be resistant to UV, ozone, chlorine, and chloramines. UV lamps shall not require a long cool down period prior to re-start should the power to the UV system fail or be interrupted for a short period of time.

Lamps shall be warranted as specified in paragraph 1-6. Replacement lamps shall be furnished at the agreed upon replacement price described in this specification and included in the UVSS's bid package.

UVSS shall provide independent laboratory certification that lamps will provide a minimum of 35 percent UV_{254} power output, that is a minimum 35 percent or greater of input power emitted as UV light at a wavelength of 254 nm after 100 hour burn-in period. This certification must be made for the expected operating temperature of the UV lamp (60 to 100°C±). UV output must be verified at maximum lamp operating temperature and that lamp temperature shall not be exceeded for this project under full scale, full power conditions.

The UVSS shall ensure disposal of the returned lamps (old/used) provided for the proper installation of the system at no cost to the Owner upon receipt of the returned lamps at suppliers designated location for lamps provided under this specification. The lamp output shall not fluctuate more than 3 percent due to water temperature variations as indicated in the design requirements. Independent test data shall be provide to show the output fluctuation. The operating skin temperature of the lamp shall not exceed 130° C in order to minimize the possibility of quartz fouling. UV lamp maximum arc shall be as defined by each supplier. The lamps shall be capable of operating in a "No Flow" condition for a minimum period of 60 minutes without causing any damage to the lamps. Systems or lamps that cannot withstand "No Flow" conditions for a minimum period of 60 minutes shall not be acceptable. The system shall be designed such that under "No Flow" conditions the channels are full of effluent and the bulbs remain submerged.

2-3.01.02. General UV Lamp Assemblies Requirements. Lamp sleeves shall be provided around each UV lamp to prevent the lamps and electrical connections from coming in contact with the effluent. Lamp sleeves shall be single piece Type 214 clear fused quartz circular tubing containing at least 99.9% silicon dioxide as manufactured by General Electric.

2-3.01.03. General UV Modules Requirements. UV modules shall consist of UV lamps mounted on a heavy gauge Type 316 stainless steel frame. Each UV lamp shall be enclosed in an individual quartz sleeve, which shall not come into contact with any steel in the frame. The ends of the lamp sleeve shall not protrude beyond the stainless steel frame of the UV module, so that the frame will help protect the lamp assembly from breakage. The UV modules shall be designed such that the Owner's personnel can change the lamps and quartz sleeves without special tools. Systems whereby the lamp assemblies have to be returned to the factory for lamp replacement are not acceptable. Type 316 stainless steel spacer/reflector panels shall be provided so that no UV light is emitted from the channel when the UV modules are installed and the lamps are energized.

2-3.01.04. General Cleaning System Requirements. An automatic and integral lamp cleaning system shall be provided as part of the UV system. The cleaning system shall at a minimum use mechanical wiping, with or without chemicals, to

de-scale the lamp sleeves. The cleaning system shall be fully operational without requiring either lamps or modules to be removed from service. The cleaning cycle shall be field adjustable and shall be activated automatically from the control system or manually at the operator interface or power distribution center. The materials used for the wiper shall be resistant to high intensity UV radiation, wastewater, chemicals in the wastewater, and fluctuations in temperature. The wiper shall be designed such that it will effectively and completely remove deposits from the lamp sleeves.

2-3.01.05. General Power Distribution Requirements. The power supply from the plant power distribution system to UVSS Power Panel shall be 480 volt, 60hz, 3-phase, 4-wire. Isolation/step-down transformers, if required shall be furnished by the UVSS and shall be the kVA and voltage ranges as required. Quantity of transformers shall be provided as required.

The UVSS shall provide harmonic filters and any other equipment required to meet IEEE 519, 1992 standards. Harmonic filters if required shall be powered and controlled from each power distribution center. If harmonic filters are furnished by the UVSS, the Contractor shall coordinate, furnish, and install all cable and conduit between the power distribution equipment and the harmonic filter(s).

The UV disinfection system shall be divided into electrical sub-systems. Each sub-system shall be powered from the power distribution center/enclosure and if required shall have waterproof cable interfacing with a watertight strain relief. Electrical supply to each power distribution center/enclosure shall be as required and derived from the appropriately sized transformer or power distribution panel.

The enclosure material and enclosure ratings for the power distribution center shall be as specified in individual equipment specification sections.

2-3.01.05.01. Transformers. The UVSS shall provide suitable voltage and capacity isolation/step-down transformers, if required for the furnished equipment control and operating voltage(s). Transformers shall be sized sufficiently, rated appropriately and wired such that the entire UV system is completely operational. Step-down transformers shall be designed for floor mounting in the UV Building Electrical Room.

Transformers shall be 3 phase dry type self air cooled. Transformers shall be designed, manufactured, and tested in accordance with the latest applicable ANSI, NEMA, and IEEE standards. Transformers shall be UL Listed.

Transformers shall be insulated with a UL recognized 220 degree C insulation system. Winding temperature rise shall be 150 degree C. Required

performance shall be obtained without exceeding the specified temperature rise in a 40 degree C maximum ambient, with a 30 degree C average.

Transformers shall be sized to supply at least 125% of the maximum UV system demand from each power distribution center/enclosure. Transformers shall have a delta primary winding and a wye secondary winding with secondary voltage ratings as required by the UVSS. Transformers shall be K rated as required by the UVSS to meet harmonic requirements.

2-3.01.05.02. Power Distribution Panels. As required, Power Distribution Panels shall be provided by the UVSS and installed by the Contractor to support the UV system loads.

Power panels shall be 3-phase, dead front panelboard with circuit breakers and Surge Protection Device (SPD). SPD shall be provided as recommended by manufacturer. Neutral shall be provided and installed as required by UVSS. Voltage rating, current rating, number of phases, number of wires and number of poles shall be determined by UVSS and in accordance with respective system requirements.

Power panel cabinet shall have a flush-mounted or surface mounted enclosure with a NEMA designation appropriate for the location where it will be installed. The enclosure shall have a door with latch and lock. Enclosure shall include neatly printed or typed circuit schedule mounted on inside of door.

Power panel circuit breakers shall be thermal-magnetic, bolt-in, individually front replaceable, and shall indicate "On", "Off", and "Tripped". Breakers indicated as multiple-pole shall be common trip type. Breakers for 277 volts shall have interrupting ratings not less than 25,000 amperes. Breakers for 480 volts shall be rated 600 volts, with interrupting ratings not less than 25,000 amperes at 480 volts.

Power panel buses if required by the UVSS shall have 3 phase buses, a neutral bus insulated from the cabinet as required, and a ground bus. Buses shall be copper, with ampere and voltage ratings and main lugs or breakers as required. The ground bus shall be similar to a neutral bus and shall have a good ground connection to the cabinet.

2-3.01.06. General Wiring and Connections Requirements. All wiring and electrical connections shall be protected against moisture and other elements (dust) to prevent electrical shorts or failure. All electrical components, installation, wiring, and controls on or within the UV disinfection system as a whole shall be designed, constructed, and installed by the UVSS and in accordance with the current edition of the National Electrical Code and all applicable state and local electrical codes.

External wiring to and from the control panel, except as noted, and power disconnect and alarm circuits shall be furnished and installed under the electrical section. All terminations, if needed between the lamps and ballasts shall be performed by the Contractor. Such terminations shall be tested and verified by the UVSS. The Contractor shall provide the wiring from the ballasts to the lamps where individual wires are used. Wire quantities and costs shall be clearly identified in the Bid Form. Contractor shall be responsible for installing the wiring.

2-3.01.07. General Instrumentation and Control Requirements. All instrumentation used in the UV disinfection system for control or monitoring shall be individually fused or circuit breaker protected to minimize the effects of any single point of failure. All instrumentation shall be designed for use in the application for which the UV system is using it. All instrumentation shall be installed as per UVSS requirements.

2-3.01.07.01 Equipment Tags. All equipment provided by the UVSS shall be required to have a unique asset tag number. UVSS shall be responsible for coordination of tag number with Engineer and Owner. Tag number format for UV disinfection equipment shall be as follows:

65UV-XYZ

where X = Channel Number (1 or 2)
Y = UV Bank Number (1,2,3 or 4)
Z = Optional UV Module Number (0 if no module number is required)

2-3.01.07.02. Influent Flow Control. Influent flow to each disinfection channel shall be controlled by a rising stem slide gate and actuator supplied by the UVSS. The UVSS shall be required to control the slide gate to full open or full close for each channel.

2-3.01.07.03. Level Control. Level control shall be a downward opening weir gate, actuator and ultrasonic level sensor provided by the UVSS that will allow for the system to meet the head loss requirements across the system as defined in this specification. UVSS shall be required to integrate level control with the overall control scenario in the system PLC and control panel. In order to protect the lamps from being run dry in case the water level drops, the UVSS shall provide one hard-wired electrode/conductance level switch.

2-3.01.07.04. Flow Indication. Each UV channel shall rely on a calculated flow value based on water surface elevation and weir gate position installed at the end of each UV channel under 2-3.01.07.03. An additional level sensor in each

channel shall be installed to provide the signal required for the flow. The PLC provided by the UVSS shall be configured to perform the required calculation per the following equation:

$$Q = 3.33 * (H - h)^{3/2} (B - 0.2 * (H - h))$$

where Q = Flow in cfs
H = Water surface elevation in ft.
h = Top of weir elevation in ft.
B = Width of weir in ft.

Plant flow meters can be available for calibrating the UVSS calculated flow equipment described in this section. The UV system shall rely on the calculated flow value from each channel for operation of the system.

2-3.01.07.05. System Control Cabinet. The UV system shall be provided with a PLC based control system furnished by the UVSS. The UV control system shall be furnished configured and completely commissioned by the UVSS. See specification Section 13530 Process Logic Controller for PLC and PLC accessory requirements. The UV control system shall be provided with an Ethernet data highway network to communicate with the operator interface, each of the power distribution centers and cleaning system. The Ethernet switch is specified in Section 13530.

The UVSS shall be responsible for listing all communication cable requirements necessary for communication from the UV PLC to any associated local control panels.

The PLC and operator interface shall be housed in a local control panel enclosure. The local control panel shall be a CSA or UL approved, NEMA 12 rated enclosure and be located in the electrical room.

The UV control system shall be capable of UV dose control of UV channels and banks based on the flow calculated by the UV PLC, intensity measurements, and transmittance measurements. The control centers shall provide complete operator interface through a display screen and message keypad or touch screen integrated into the UV control system cabinet. Keypads, hardwired panel devices, and meters shall not be permitted. Operator interface shall be menu driven with automatic fault message windows appearing upon alarm conditions.

All control mode status, control set points, equipment status, alarm and data points in the UV system shall made available at the local Operator Interface Terminal (OIT). The UVSS shall assist the Owner to ensure that the controls and data signals described in this section are provided to the PCS. The UVSS shall

furnish to the Owner an executable computer file copy of the PLC program (including an annotated version), OIT database and graphics, and a PDF file containing a copy of the PLC logic before shipment of the equipment for use in configuring the PCS system. The UVSS shall provide updated versions of this information during the field commissioning startup and testing including the final version before acceptance of the system. Equipment will not be accepted without previous submittal of this information. The electronic file shall be documented to clearly indicate the function of each rung in the logic. In addition, the printout shall include memory usage documentation to indicate all memory locations used Any alarm that interrupts operation or automatic control of the UV disinfection system must be accessible by an operator without password protection. Password protection shall be limited be limited to access for changing set point values and programming code.

The controller shall have the following features:

- Each bank shall be capable of being placed in either the Hand, Off, or Auto mode.

- The module banks shall be cycled for equal wear and timed off to minimize bank cycling.

- Elapsed time of each bank shall be recorded and displayed on the display screen when prompted.

2-3.01.07.06. Minor Alarms. Minor alarms shall be provided to indicate that maintenance attention is required and shall include the following:

a. Maximum end of lamp life hours exceeded.
b. Low UV intensity warning shall be preset at the factory for 45 percent of the intensity after 100 hours. Alarm set point shall be field adjustable.

2-3.01.07.07. Major Alarms. Major alarms shall be provided to indicate an extreme alarm condition in which the UV disinfection performance may be jeopardized. Major alarms shall include the following:

a. Low UV intensity alarm shall be preset at the factory for 25 percent of the intensity after 100 hours burn-in of the lamps. The alarm set point shall be field adjustable.
b. Critical Instrument Failure. Failure of an instrument or communications link resulting in a control signal being lost. Critical Instrument Failure may, as required by UVSS, include ground fault interruption failures when ground exceeds 10 milliamperes in any UV module. This condition shall instigate a default routine in the PLC control to put all available UV lamps

on to ensure that disinfection will be achieved if physically possible. Personnel and plant safety must be maintained at all times.

c. Failure to meet UV Dose. Failure to meet the minimum dose level either due to effluent conditions or possible plant limitations.
d. Individual lamp failure indicated by the address system specified below.
e. Multiple ballast failure indicated by the address system specified below.
f. Multiple lamp failure indicated by the address system specified below.
g. Low warning UV dose shall occur when the design dose is not being delivered. Set point shall be field adjustable.
h. Low UV transmittance shall occur when UV transmittance falls below an operator adjustable value.
i. High Temperature alarms for each individual module located within control cabinets.
j. UV system power failure. Failure of main power supply to the UV system.

Major and minor alarms shall identify the affected lamps by an address system. The address shall specify the module and lamp (e.g., Bank #1, Module #2, Lamp #2) or pair of lamps. The 100 most recent alarms shall be recorded in an alarm history register and displayed when prompted. All alarms shall energize one common alarm for each pair of banks in a channel for transmittal to the PCS.

2-3.01.07.08. Control Logic. The system shall be capable of being placed in Hand, Off, or Auto mode. When the system is in the Auto mode, the controller shall operate the system based on 4-20 mA or digital signals from either the UV intensity sensor or the on-line transmittance analyzer and the calculated flow measurement. The UV system controller shall also open the associated UV channel inlet gate, level control gate, and the system shall be capable of operating under all flow conditions. The control system must have the flexibility either automatic or manual designate lead, lag, and 2nd lag automatic in-service channels and modules. This is to minimize imbalance of lamp and module run time. Programming shall be provided to balance or equalize the level control gate position when a new channel comes on line with the gate position in the channel or channels that are already in service. This balance shall converge within 5 minutes and be within 1 inch in both channels. Gate position feedback must be incorporated into the channel level controls for the disinfection system dosage control to function properly. Effluent gates shall close before lamps shut off when modules or channels of modules are taken out of service. Programming shall provide for powering up of the lamps at the same time the inlet gates begin to open. The lamps for any channel shall be allowed to warm up via programming in the PLC to full dosage output before effluent gates adjust and allow discharge to occur.

The control system shall turn UV banks on and off or vary the power to the lamps in relationship to these 4-20 mA or digital signals. If flow pacing is desired, the control system shall adjust the power of the UV banks as described below. Logic

and time delays shall be provided to regulate the UV bank On/Off cycle. In Hand mode, no automatic functions shall exist and the channel inlet gate shall be opened and closed using commands entered at the UV system controller's OIT. When the UV system is off, the channel inlet gate shall close. During the startup of lamps in various channels, lamps shall be operated at 100 percent output for a minimum of 60 minutes.

If the flow calculation times out or fails the control system shall automatically bring all UV channels on line and energize all UV lamps to the full power setting. When opening gates, controls system shall be programmed to minimize the discharge of undisinfected water.

2-3.01.07.09. UV Pacing. The UV system supplier shall provide its standard equipment for pacing the lamp output to meet an adjustable operator set point for delivered UV_{254} dose in terms of $\mu W \bullet sec/cm^2$. The UV control system shall use the calculated flow rate to determine the required UV light intensity ($\mu W/cm^2$) within the UV reactor, using either a direct reading of the intensity via a self-cleaning sensor or a manually adjustable input of the UV_{254} transmittance.

2-3.01.07.10. Plant Control System Interface. The UV PLC shall transmit system data to the Plant Control System (PCS) as described above. The UVSS shall arrange the data into packets of data that can easily be transferred to the PCS. The minimum data signals are listed below. Any additional I/O signals that the UVSS typically recommends to be monitored shall also be included in the data packets for transfer to the PCS. The UVSS controls representative shall be responsible for testing and proving that the PLC data transmitted to the PCS is accurate.

The functional intent is to allow full monitoring and remote control of the UV system through the local UV system operator interface. The PCS shall only monitor the UV system. No PCS control features shall be required.

At a minimum, the following information shall be communicated from the UV system controller to the PCS:

- UV system in operation
- UV set points and analog values from UV instrumentation
- All major and minor alarms identified above shall generate a common alarm for each pair of UV banks within a channel.
- Individual hours tracking for lamps

2-3.01.07.11. Intensity Sensor. The intensity sensor shall be compliant with UVDGM, DVGW, or ONORM standards. Each UV bank shall be provided with a UV intensity sensor, mounted in the center of a representative UV module and

connected to a central system control center. The UV intensity sensor shall have at least 95 percent sensitivity to only the germicidal portion of the spectrum (253.7 nm). The sensor shall not use a filter or degrade after prolonged exposure to UV light. Sensor readings shall be displayed on the control screen and shall be accurately calibrated to provide a current that is proportional to the UV intensity and a digital readout from 0 to 100 percent of maximum intensity or in mW/cm^2. The sensor shall be automatically cleaned at the same frequency as the lamp sleeves to prevent fouling of the sensor and hence spurious false alarms for low intensity.

In the event that the UV intensity from any of the modules drops below a set point, a common alarm bit in the PLC shall open in the control unit for remote alarm to the PCS. The set point for activation of the alarm shall be adjustable over the entire range of 0 to 100 percent of maximum intensity. An intensity monitor in a UV unit which has been turned off for low flow operation shall also be turned off so as to prevent the alarm from activating on the main control panel. An adjustable time delay (variable from 0-20 minutes) to bypass the alarm on start and warm-up of the lamps and system shall be provided if required to prevent nuisance alarms.

2-3.01.07.12. On-Line UV Transmittance (UVT) Sensor. One online UVT sensor shall be provided for continuous monitoring of the UVT in the influent. The UVT sensor shall be a continuous-reading sensor that utilizes a 2-beam ultra-violet absorption technology with a 5 mm path length. The measurement range shall be 0 to 3000 absorption units (m-1) and transmittance from 0 to 100 percent. The measurement interval shall be user-selectable. The sensor shall provide reagent-free operation without the requirements of sample conditioning. The sensor shall be self-cleaning via a wiper and retain a life-long factory calibration. The sensor shall be provided with the mounting hardware for installation submerged into the channel.

The sensor shall also be provided with a sensor controller display. The Controller shall be "plug and play", and shall allow proper digital communication with the UVT sensor.

The sensor shall be the UVAS sc tank sensor for UV absorbance/transmittance measurement, manufactured by Hach Company without exception. The UVT sensor controller shall be the Model sc200 by Hach Company without exception. UVSS shall be responsible for integration of signal from Hach on-line transmittance sensor to system PLC. No other sensor will be acceptable.

2-3.01.07.13. UV Dosage Monitor. to the UV system shall calculate, display, and record the delivered UV dose in $\mu W \bullet sec/cm^2$. The value shall be recorded and displayed at the control panel. A 4-20 mA analog output shall be available for interfacing with the system control center.

2-3.01.07.14 Uninterruptible Power Supply. The UVSS shall provide a UPS for all PLC control and communication equipment. The UPS is specified in section 13530.

2-3.01.08. Spare Parts. In addition to the spare parts listed above, any special tools required to facilitate maintenance of any component of the UV system shall also be furnished. All spare parts shall be in waterproof packages suitable for export service, labeled with the description and part numbers. Each item or set of parts expected to be installed at one time shall be in an individual package.

2-3.01.09. Shop Tests. Prior to shipment, the UV units shall be operated to check for leaks, faulty equipment and controls, and proper wiring. The UV intensity monitor shall be calibrated to the manufacturer's specifications. Defective equipment and controls disclosed by such tests shall be replaced and the equipment package placed in satisfactory operating condition before shipping. UVSS shall submit a report showing the results of the shop testing and any modifications that occurred.

2-3.01.10. Permanent Nameplates. The equipment shall be provided with permanent engraved stainless steel nameplates. Identification to be used shall be as directed by the Owner and shall be located in a conspicuous place acceptable to the Owner. The nameplates shall have letters not smaller than 3/4 inch. The letters shall be painted black after fabrication. Each module also shall be labeled with an engraved stainless steel serial number plate which shall be permanently attached to the module.

2-3.01.11. UVSS Nameplate. Each major component of equipment shall have the UVSS name, address, and model/catalog number on a nameplate securely affixed to the equipment. The nameplate of the distributing agent only will not be acceptable.

2-3.01.12. Lifting Eyes or Lugs. All equipment weighing more than 50 pounds shall be provided with lifting eyes, lugs or have another manner for removal of the UV equipment from the UV channels. The UVSS shall supply any special lifting slings or equipment required for removal of components.

2-3.01.13. Stilling or Baffle Plates. Stilling or baffle plates will be provided by the UVSS as required in the California DPH Conditional Acceptance requirements.. Baffle plates shall be constructed of 304 SS.

2-3.01.14. Safety Equipment. Safety equipment consisting of 10 personnel goggles/face shields for protection against UV energy between 200 to 400 nm wavelength. Eight UV area warning signs shall be provided.

2-3.01.15. Bench Photometer. A single beam UV photometer with front panel and 100 percent transmittance control adjustment shall be supplied to measure the UV transmittance of the effluent. The range shall be 0-100 percent transmittance with a wavelength accuracy of +0.16 half bandwidth. Accessories shall include two matched quartz cuvettes, 100 percent T standard solution, and cuvette cleaning solution.

2-3.01.16. Factory Test. Prior to shipment, each UV unit shall be operated to check for leaks, faulty equipment and controls, and proper wiring. The UV intensity monitor shall be calibrated to the UV system supplier's specifications. Defective equipment and controls disclosed by such tests shall be replaced and the equipment package placed in satisfactory operating condition before shipping. The Owner at his option may attend the factory test. The UVSS shall coordinate the timing of the factory test to allow the Owner or his designee desires to attend. UVSS shall submit a report detailing the findings of the factory test for approval by the Engineer.

PART 3 - EXECUTION

3-1. INSTALLATION AND OPERATION. Equipment shall only be installed and operated by, or with the guidance of, qualified personnel having the knowledge and experience necessary to obtain proper results.

Qualified field representatives shall be provided by the UVSS as required to perform all manufacturer's field services described in this specification. The UVSS field representatives shall observe, instruct, guide, and direct Contractor's erection and installation procedures, or perform an installation check, as required. A UVSS field representative shall revisit the site as often as is necessary to assure the installation is satisfactory to Engineer.

All equipment installed under this Contract shall be placed into successful operation according to the written instructions of the UVSS or the instructions of the UVSS field representative. All required adjustments, tests, operation checks, and other start-up activities shall be provided. The UV units shall be leveled, aligned, and placed into position in the open channel shown on the Drawings. Installation procedures shall be as recommended by the UV equipment manufacturer and as required herein. Written reports regarding installation shall be provided to Owner.

Contractor shall adequately brace the baffle to insure it remains in place as required by the UVSS prior to placing of concrete. Concrete forming and placement operations shall be carried out to maintain the tolerances in the channel configuration, width, and depth, required by the UVSS.

3-1.01. Installation. The UV banks/modules shall be leveled, aligned, and placed into position in the open channel shown on the contract drawings.

Installation procedures shall be as recommended by the UVSS and as required herein. If needed, grouting shall be as specified in the grout section. Contractor shall adequately brace the baffle to insure it remains in place as required by the manufacturer prior to placing of lean concrete. Concrete forming and placement operations shall be carried out to maintain the tolerances in the channel configuration, width, and depth, required by the UVSS.

3-2. UVSS FIELD SERVICES. An experienced, competent, and authorized representative of the UVSS shall provide field services for equipment furnished under this section. Field services shall meet the requirements of UVSS Field Services in the quality control section. A factory representative shall be on-site for commissioning.

3-3. PERFORMANCE TESTING. The UVSS shall guarantee that the UV system, including all equipment as specified herein and all ancillary equipment is capable of achieving inactivation equivalent to the design germicidal UV dose without exceeding the Guaranteed Energy Cost and the Guaranteed Maximum Headloss for the entire UV system listed in the UVSS's bid package. Performance tests shall be conducted based on conditions for power use, flow, UV transmittance, and dose as specified in the Bid Documents. All Performance Testing shall be conducted in accordance with Section 13704 – Performance and Validation Testing. Testing protocols shall be submitted with the shop drawings.

3-4. EQUIPMENT ACCEPTANCE. Within fifteen days after the initial tests and any retests, five copies of a testing report shall be generated and transmitted to the Owner and Engineer for review. The Engineer and Owner shall review the report and promptly thereafter notify the UV system supplier in writing whether or not the report and/or equipment is acceptable. Systems that do not achieve the guaranteed energy cost shall not be acceptable. Modifications shall be made at the UVSS's expense to provide a system that is acceptable to the Owner. The modified system shall be retested to the satisfaction of the Owner and Engineer. Additional costs associated with the Engineer's attendance at all retests shall be the responsibility of the UVSS unless sufficient information exists to prove the UVSS is not at fault for the failure.

If after the second or any subsequent retests allowed, the equipment does not meet the performance requirements, the Owner may, at the Owner's option, select one of the following courses of action:

a. Allow the UVSS to make additional modifications and retests. All costs associated with witnessing retests shall be at the UVSS expense including but not limited to time and expenses for Engineering and Contractor personnel.

b. In addition to the modifications, liquidated damages may be assessed and

levied at the discretion of the Owner if the noncompliance is faulty equipment or negligence on the part of the UVSS. These damages will be based on the present worth of the difference between the power requirements submitted by the UVSS in their bid package and what was measured during the performance test. Liquidated damages for power will be assessed at a rate of $0.10 per kilowatt-hour exceeding the value submitted per day x 24 hr/day x 365 days/year. Additional liquidated damages of 2 man hours @ $60/hr per week will be imposed to account for increased maintenance. Power and maintenance costs on a yearly basis will be multiplied by a 20 year present worth factor of 12.46. The resultant value represents the penalty for underperformance that the Owner will incur over the 20 year system life cycle.

c. Should the UV system fail to meet the UVSS's maximum head loss provided in the bid package all necessary system upgrades including but not limited to channel modifications, weir modifications, etc. shall be supplied at the UVSS's expense. If additional equipment is required, such as pumps, etc. the UVSS shall purchase the equipment and pay for all installation costs. Further the UVSS shall be responsible for all power costs associated with operation and maintenance of the additional equipment for the duration of the 20 year life cycle calculated similarly to that shown in item b above. Man hours for equipment maintenance will be based on 2 man hours per week @ $60.00/hr.

d.. Reject the equipment and require the UVSS to remove all equipment from the site, with the UVSS refunding all payments received and compensating Owner for cost of a replacement system and any resulting construction costs required for the replacement system.

3-5. COMMISSIONING. No system or sub-system shall be started-up for continuous operation unless all equipment, including instrumentation and monitoring systems, of that system or subsystem have been tested and proven to be operable. The UVSS shall place the equipment into operation and perform tests to determine if equipment is operating properly. The purpose of these tests is to verify that both the system and each ancillary unit are:

- Properly installed
- Operational
- Capable of completing operating cycles free of problems
- Free from overheating, overloading, vibration, or other problems

The UVSS shall verify that control programming has been configured with appropriate software time delays and interlocks to avoid unsafe operating conditions.

3-5.01 Start-up Activities. The UVSS shall coordinate all activities thru the Contractor with agreement from Owner and Engineer. The types of activities to be performed by the UVSS will be detailed in the "Detailed Plan of Start-up Activities", submitted a during the shop drawing process for review, and shall include but are not necessarily limited to the following items:

- Initial Start Up Activities
- Verify Tags
- Verify System Connections
- Verify Instrumentation and Control
- Verify PLC Ethernet Communication to power distribution centers and cleaning system
- Verify OIT Communication
- Test Electrical Connections
- Test Level Control
- Test Level Switches
- Test and Calibrate UVSS Process Instruments
- UV Transmittance Transmitters
- UV Intensity Transmitter
- Level Transmitters
- Temperature Transmitter
- Verify External Signals are available to the UVSS Panel
- Flow Meters

3-5.02. Commissioning Activities. The UVSS shall provide operational plans for commissioning the system during the shop drawing process. The UVSS shall provide a procedure and plan for performance testing and the spot check bioassay testing during the shop drawing process for review by the Owner and Engineer. Commissioning activities will include but not be limited to the following:

- UV Disinfection Reactors / Banks placed into service in Manual and Automatic Mode
- Check Start Up Sequence in Normal and Emergency Modes
- Check Shut Down Sequence in Normal and Emergency Modes
- Check Process Logic Interlocks
- Spot-Check Bioassay Test
- 30 Day Automatic Continuous Operational Performance Test

3-5.03. Additional Start-up Activities. As a part of the commissioning, the UVSS shall start-up and operate all support systems provided by or required by the UVSS for operation of the system. The Contractor shall furnish materials

(excluding power), instruments, and incidental and expendable equipment required for commissioning / placing the equipment into operation. The UVSS shall oversee the installation of the UV Lamps by the Contractor. The location and serial number of each UV disinfection module shall be provided using a Microsoft Excel Spreadsheet. This information will be used to document UV disinfection Warranty replacement. The Engineer may perform random tests to determine if the equipment is operating properly and witness various operational sequences. In addition, the Engineer may initiate alarm conditions during this test to determine if the control system is functioning properly. The Engineer will review information on the OIT interface, PLC system commissioning, and PCS interface requirements to determine conformance with the specifications.

3-6 PERSONNEL TRAINING. An experienced, competent, and authorized representative of the UVSS shall train the Owner's personnel in operating, maintaining, and repairing the equipment specified in this section. Prior to scheduling training the UVSS shall submit a lesson plan and materials to the Owner and Engineer for review.

The UVSS shall provide training of the Owner personnel. Training of the owner personnel shall commence as mutually agreed to by the Owner, Engineer, Contractor and UVSS. A 4-hour classroom training shall be provided and may be scheduled as required by the Owner's personnel. Multiple training sessions may be required to facilitate training of all shifts. The UVSS shall maintain record of the individuals that have completed training and provide information required for the documentation of Professional Development Hours required by the Owner.

Training sessions may be video taped by the Owner at the Owner's expense. Training material shall be provided to the Owner in written and electronic format. The UVSS shall be responsible for all costs associated with training and shall provide required materials, texts, and supplies.

The UVSS shall provide a combination of classroom and hands-on training. All training shall be conducted at the Owner's location.

The following Levels of Training Shall Be Provided.

Level of Training	Number of Shifts	Maximum Number of Participants	Classroom Training (Hours)	Hands-On Training (Hours)
UV Disinfectant System	2	8	2	4
Mechanical Equipment	2	8	2	4

Level of Training	Number of Shifts	Maximum Number of Participants	Classroom Training (Hours)	Hands-On Training (Hours)
Electrical Instrumentation and Control Equipment	2	4	4	4

Training schedule should be extended to allow no more than 4 total hours of training in any one day per person. Training shall include but not be limited to a description on how the PLC works, its logic for controlling the system, alarm and alarm set points, system adjustments, PCS interface, and troubleshooting of the entire UV system.

Hands-On Training shall be limited to groups of 8. In the event that more than 8 personnel are to be trained, multiple hands-on training sessions shall be conducted.

Training shall be performed by the UVSS and component equipment suppliers. The UVSS shall be responsible for the training on the design and operation of the equipment and systems provided. This includes:

1. UV Disinfection System
   a. UV disinfection Theory
   b. UV disinfection System Overview
   c. UV disinfection Reactors, Banks, Modules and Lamps
   d. UV disinfection Processes (Start Up, Shut Down, Flow and Dose Pacing, Transmitter Maintenance, Routine and Non-Routine Maintenance, Troubleshooting System)

2. Mechanical Equipment Training
   a. Mechanical Equipment
   b. Instrumentation and Control Component Equipment Training (Switches, Meters and Transmitters, Analyzers)
   c. Troubleshooting Mechanical System

3. Electrical, Instrumentation and Control Process Logic Control/OIT Training
   a. Electrical Control Design
   b. PLC and Communication Equipment
   c. PCS interface with PLC
   d. OIT Functional Training
   e. Troubleshooting Electrical System

Training Manuals shall be provided with the PRELIMINARY O&M Manuals.

3-6.01. Special Project Considerations.

3-6.01.01. Training Aids. The UVSS'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. Texts shall be bound within three-ring binders. Other appropriate training aids are:

- Audio-visual aids (e.g., films, slides, videotapes, overhead transparencies, posters, blueprints, diagrams, catalogue sheets)
- Equipment cutaways and samples (e.g., spare parts and damaged equipment)
- Tools (e.g., repair tools, customized tools, measuring and calibrating instruments

The UVSS'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 required and shall be provided to the City. Handouts planned for the instruction shall be attached with the manufacturer's proposed lesson plan.

3-6.01.02. "Hands-On Demonstration". The UVSS's instructor shall present "hands-on" demonstrations of operations and maintenance of the UVSS supplied and component equipment. The proposed "hands-on" demonstrations should be described in the UVSS's proposed lesson plan.

End of Section

Section 13701P

LOW PRESSURE HIGH OUTPUT UV REACTORS
ALTERNATIVE A

PART 1 - GENERAL

1-1. SCOPE. This section covers the design requirements, materials, product data, start-up, commissioning, and performance testing for low-pressure high output (LPHO) UV Reactors.

The UV System Supplier (UVSS) shall provide the required information to the Owner and its Engineer as required for the design of facilities associated with the Arrowhead Ranch Water Reclamation Facility (ARWRF) UV Replacement Project.

It is the intent of this specification to establish minimum equipment and quality standards for the UV disinfection system. It is the UVSS responsibility to coordinate with the selected Contractor and together provide all parts, equipment, materials, and components required for a complete and functional system, including any performance testing.

The equipment furnished under this alternative shall be the UV3000Plus as manufactured by Trojan Technologies. Equipment provided shall meet all requirements of Section 13700P - GENERAL UV SYSTEM REQUIREMENTS, Section 13704P - UV SYSTEM PERFORMANCE AND VALIDATION TESTING and all constraints described in this specification. Any exceptions or deviations from this specification or others shall be clearly document in the UVSS Bid Form and Technical Information Submittal identified in the "Instructions to Bidders" Section.

PART 2 - PRODUCTS

2-1. CONSTRUCTION.

2-1.01 UV Lamps. Lamps shall be LPHO amalgam type. The coiled filamentary cathodes shall be heated by arc current. Lamps shall be preheated to promote longevity. Filaments shall be of clamped design, significantly rugged to withstand shock and vibration. Electrical connections shall occur at one end and each connection shall have four pins. Minimum UVC power output shall be 125 watts at 253.7 nm after 100 hour burn in. Lamp bases shall be glazed finish resistant to UV and ozone. The base shall be stepped internally and bridged externally to provide additional electrical isolation between electrodes. The barrier shall be dielectrically tested for 2,500 volts. Lamps shall have a 1.47 m

minimum arc length, with a 28 mm nominal outside diameter. Four Teflon O-rings shall be equally spaced to center the lamp within the quartz sleeve. The system shall be designed for complete immersion of the lamps, including both electrodes and the full length of the lamp in the process fluid. Both lamp electrodes shall operate at the same temperature and shall be cooled by the process fluid.

2-1.02 UV Lamp Assemblies. Lamp sleeves shall be rated for a minimum UV transmission of 90.8 percent and shall not be subject to solarization over the length of their life. Lamp sleeve nominal wall thickness shall be 1.5 mm, and shall be domed at one end.

The open end of the lamp sleeve shall be sealed by means of a plastic sleeve nut which threads onto a sleeve cup and compresses the sleeve O-ring. Sleeve nuts shall have a knurled surface to allow a positive hand grip for tightening. The sleeve nut shall not require any tools for removal. Lamps shall be held in place by a molded PVC lamp holder that shall incorporate two seals. The double seal of the lamp holder against the inside of the quartz sleeve shall act in series with the external O-ring seal. The second seal on the lamp holder shall isolate and seal the lamp from the module frame and all other lamps in the module. In the event of a quartz sleeve fracture, the two seals of the lamp holder shall prevent moisture from entering the lamp module frame and the electrical connections to the other lamps in the module.

The lamp holder shall also incorporate a Type 304 stainless steel grounding ring and a UV resistant PVC molded stop that shall prevent the lamp sleeve from touching the steel sleeve cup.

2-1.03. UV Modules. UV modules shall consist of 8 lamps with an electrode ballast enclosure mounted on the frame. Each lamp shall be enclosed in an individual quartz sleeve, consisting of one closed end and one end sealed with a lamp end seal and compressed O-ring. The closed end of the quartz sleeve shall be held in place by a retaining O-ring.

Lamp wires shall terminate in the electronic ballast enclosure located at the top of the module. All wires connecting the lamps to the ballasts and the power cables from the ballasts to the Power Distribution Center shall be enclosed inside the frame of each UV module and not exposed to the process fluid. Each lamp module shall disconnect all power to the lamps when a module is removed from the channel, or the module shall be unplugged prior to removal from the channel. The UV modules shall be designed for complete submergence at water depth of 6 feet above modules without causing failures or damage to the system or components for 24 hours. Modules shall not contain any components, such as electronic cards, that cannot withstand complete submergence.

The electronic ballast enclosure shall contain the electronic ballasts and a lamp status monitoring systems (at OIT). Each UV module shall be connected to a receptacle on the Power Distribution Center by means of a multiconductor cable with a molded connector. At the point of exit from the module frame the multiconductor cable shall pass through a waterproof strain relief.

2-1.04 UV Lamp Module Support Rack. The module support rack shall be minimum Type 304 stainless steel. The support rack shall be suspended above the process fluid by slotted angles that allow for adjustment to the precise height of the channel and shall not require fastening of the individual lamp modules. The module support rack shall be designed so that no UV light shall radiate above the channel when the lamp modules are energized and fully immersed in the process fluid. The support rack shall be designed to allow removal of the modules from the channel by overhead crane.

2-2. ELECTRICAL

2-2.01 Electrical. The UV disinfection system shall be divided into parallel electrical sub-systems. Each UV module shall be powered from a dedicated Power Distribution Center through a bus bar and shall include a ground detection/fused relay board, and watertight connector. Variable output electronic ballasts shall operate from a 60 Hz single phase source over a nominal range of 220 to 277 Vrms ± 10 percent. Each ballast shall drive two lamps. Ballast input shall range from 300 W to 500 W ± 2 percent. Power factor shall not be less than 98 percent leading or lagging. Maximum permissible inrush current shall not exceed 10 amps rms or 15 amps peak. Maximum permissible leakage current at 60 Hz shall not exceed 3 mA.

Electrical supply to each System Control Center (SCC) shall be 120 Volt, single phase.

Electrical supply to each Power Distribution Center shall be derived from a power panel as specified in Section 13700.

Ventilation of control panels that contain electronic circuit boards shall be provided if required by the manufacturer.

Electrical power supply to the Hydraulic Systems Center shall be 480 volt 3 phase 3 wire.

UV system supplier shall perform all terminations between lamps and ballasts. UV system supplier shall supply all cabling and conduit between lamps and ballasts.

2-2.02 Power Distribution Centers (PDC). All Power Distribution Centers shall be self-supporting and shall be provided with a Type 304 stainless steel

enclosure, with a minimum rating of NEMA 4X. One separate sealed PDC shall be provided per bank of lamps. Power distribution shall be through bus bars to environmentally sealed receptacles to allow for local connection of UV Modules.

Data concentration shall be through integrated circuit boards located inside the PDC.

2-2.03. Wiring and Connections. The UV module connectors shall be watertight with a molded backshell to meet the requirements of UL574 for direct water jet spray when mated. Each connector shall have less than 277 volts across any pin to ground and shall be automatically disconnected from power when uncoupled. The connector pins shall be brass with silver plating. Each pin when mated shall seal with a "cork and bottle" seal. The ground pin shall be longer than the other pins giving a "make first break last" ground connection. The body of the nut and receptacle shall be stainless steel.

2-2.04. Electronic Ballast. Ballasts shall drive a pair of lamps with independent control and monitoring circuits providing independent lamp status to the PLC. The ballasts shall be electronic microprocessor controlled. The ballast shall produce an earth free lamp power supply operating at above supply frequency and optimized to preserve lamp life.

Ballasts shall detect lamp failure and initiate a re-strike sequence independent from external influence. Ballasts shall attempt three re-starts before shutting down. Ballasts shall incorporate a galvanic separation of the two circuits. In case of the secondary circuit operating under abnormal voltage or amperage conditions the ballast shall shut off the affected lamp. Ballasts shall incorporate a filament pre-heat circuit to minimize lamp failure on start.

Ballasts shall be held in a standby mode when not in operation to reduce start-up time and minimize stress on electronic components induced on power up.

2-3. INSTRUMENTATION AND CONTROL

2-3.01. System Control Center (SCC). The SCC shall be provided as specified in Section 13700. UV system control and monitoring shall be provided through an Operator Interface Terminal (OIT) to allow complete operator interface and control. Hardwired panel devices and meters shall not be permitted. OIT will be provided as specified in Section 13530. Operator interface shall be menu-driven with automatic fault message windows appearing upon alarm conditions. As a minimum, the system shall display and transmit the alarms described in this section. Bank status shall be capable of being placed in Manual, Off, or Auto mode. Banks shall be cycled for equal wear and timed off to minimize bank cycling. Elapsed time of each bank shall be recorded and displayed on the OIT when prompted.

On-Line RMI SystemTM: SCC shall include the capability for remote diagnostics

by the UV system supplier (UVSS). If necessary, remote diagnostics by a UVSS technician will be through a dedicated telephone line modem connection

terminated in the SCC. The modem may be enabled/disabled at the SCC by plant personnel upon request.

PLC's supplied as part of this project shall be as specified in Section 13530. The PLC shall be capable of exchanging data with the Plant Control System (PCS) through the plant's data communication network. As described in 13700, the PLC data registers shall be made available to the System Integrator for incorporation into the overall PCS. An Operator Interface Terminal (OIT) shall be mounted in the PLC cabinet door. System operating information shall be displayed on the OIT in both color graphic and text format.

2-4. CLEANING SYSTEM

2-4.01. Cleaning System. The cleaning system shall have integral mechanical and chemical cleaning abilities, complete with an automatically initiated and controlled cleaning cycle. The cleaning system shall be fully operational without requiring lamps or modules to be taken out of service. Cleaning cycle intervals shall be field adjustable from once every 12 hours to once every 500 hours. Remote Manual and Remote Auto cleaning control shall be available through the OIT. The system shall be provided with the required cleaning reagents and solutions necessary for initial equipment testing and for equipment start-up.

A Hydraulic Systems Center (HSC) shall be required to house all components required to operate the automatic cleaning system. The HSC enclosure shall be constructed in Type 304 stainless steel. The HSC shall contain a hydraulic pump complete with integral 4-way valve and fluid reservoir housed inside the enclosure. All tubing and piping shall be Type 316 stainless steel.

End of Section

Section 13702P

LOW PRESSURE HIGH OUTPUT UV REACTORS
ALTERNATIVE B

PART 1 - GENERAL

1-1. SCOPE. This section covers the design requirements, materials, product data, start-up, commissioning, and performance testing for low-pressure high output (LPHO) UV Reactors.

The UV System Supplier (UVSS) shall provide the required information to the Owner and its Engineer as required for the design of facilities associated with the Arrowhead Ranch Water Reclamation Facility (ARWRF) UV Replacement Project.

It is the intent of this specification to establish minimum equipment and quality standards for the UV disinfection system. It is the UVSS responsibility to coordinate with the selected Contractor and together provide all parts, equipment, materials, and components required for a complete and functional system, including all functional and performance testing.

The equipment furnished under this alternative shall be the TAK 55 HP as manufactured by ITT/WEDECO, or approved equal. Equipment provided shall meet all requirements of Section 13700P - GENERAL UV SYSTEM REQUIREMENTS, Section 13704P - UV SYSTEM PERFORMANCE AND VALIDATION TESTING and all constraints described in this specification. Any exceptions or deviations from this specification or others shall be clearly document in the UVSS Bid Form.

PART 2 - PRODUCTS

2-1. CONSTRUCTION

2-1.01. UV Lamps. Lamps shall be low-pressure mercury amalgam "dotated", high intensity type. Lamps shall be capable of producing a minimum, new lamp (100 hrs.), output of 138 watts per lamp of UV-C energy at a wavelength of 253.7 nm (254 nm). The UV output energy of the lamp shall be variable output. Lamps shall be capable of maintaining a UV-C output proportional to the variable power settings from the ballast. Lamp filaments shall be the clamped design, significantly rugged to withstand shock and vibration. The lamp maximum arc length shall be 56.3 inches. Lamp bases shall be metal and ceramic construction resistant to UV and ozone.

2-1.02. Lamp Assemblies. Each lamp assembly shall consist of a lamp, enclosed in an individual quartz sleeve, with ends sealed using an O-ring sealed quartz end plug. Lamps shall be removable with the quartz sleeve and wiper system remaining in place. Quartz sleeves shall be fixed to the module frame using stainless steel clips on the end plugs of the sleeve. Lamp sleeves shall open at both ends and shall be rated for a minimum UV transmittance (254 nm) of 92 percent. Lamp sleeves transmittance shall not be subject to degradation over the life of the system.

All electrical connections on the lamp assembly shall be made at one end through a four pin, machined, watertight plug connector. The electrical connection end of the quartz sleeve shall be sealed by a protective retainer plug with dual O-rings to seal and hold the sleeves in parallel alignment. The retainers shall remain in place to protect the quartz sleeves against accidental damage without impeding the removal and replacement of the lamp.

Lamp sockets shall be centered against the inside of the quartz sleeve and shall be retained by a cap nut with a ribbed exterior surface. The cap nut shall provide a positive handgrip for tightening/loosening without the need for any tools. The cap nut connection shall include a self contained O-ring, that seals the lamp and socket assembly independent from the quartz sleeve.

The system shall be designed for complete immersion with up to 6 feet of water above the modules, including both electrodes and the full length of the lamp in the process fluid for 24 hours without failures of any components. Both lamp electrodes shall operate at the same temperature and be cooled by process fluid.

The lamp assembly design and UV module mounting shall allow all of the following to be easily achieved by an operator for maintenance purposes:

- Disconnection of lamp power cable only, without removing the UV lamp or the lamp assembly from the module.
- Disconnection of lamp power cable and removal of the UV lamp without removing the lamp assembly from the module.
- Disconnection of the lamp power cable and removal of the entire lamp assembly without removing the lamp from the assembly.

2-1.03. UV Modules. Each module shall consist of a dual (side-by-side) row configuration of lamp assemblies. The lamp assemblies shall be held on the frame with stainless steel spring tension clips. The top of the frame shall also serve as a UV reflector shield to prevent UV light from exiting the UV process area.

Each module shall be connected to NEMA Type 4X rated modular quick disconnect plugs and sockets on a junction box for ease of removal. The UVSS shall supply two or three separate sets of multi-conductor cables each covered by a flexible stainless steel conduit to feed the junction box. The plugs shall connect the power cables to the lamps in the module, interlock and sensor cables, and wiping system air lines.

Power cables from the junction boxes to the lamps may be exposed to the process fluid if they consist of suitable material which is UV resistant.

Each module shall be equipped with an interlock switch, which shall automatically disconnect power to its associated bank if the module is raised from the channel or the quick disconnect plug is removed. The modules shall be designed for complete submergence without causing failures or damage to the system or components. Modules shall not contain any components, such as electronic cards, that cannot withstand complete submergence.

Type 316 stainless steel spacer/reflector panels shall be provided between the module reflectors so that no UV light is emitted from the channel when the modules are installed and the lamps are energized.

2-1.04. UV Lamp Module Support Rack. The module support rack shall be minimum Type 304 stainless steel. The support rack shall be suspended above the process fluid by slotted angles that allow for adjustment to the precise height of the channel and shall not require fastening of the individual lamp modules. The module support rack shall be designed so that no UV light shall radiate above the channel when the lamp modules are energized and fully immersed in the process fluid. The support rack shall be designed to allow removal of the modules from the channel by overhead crane.

2-2. ELECTRICAL

2-2.01. Electrical. The electrical system shall be robust enough to produce reliable UV disinfection. Segregation of services and supplies into sensible groups to allow for safe and simple maintenance or servicing while ensuring maximum possible disinfection capability is maintained shall be provided. Plug and socket quick disconnect facilities shall be provided to enable non-technical personnel to carry out lamp replacement, wiper insert replacement, etc. without the need for any tools or specialist isolation procedures. Lamp to ballast cable terminations within the ballast enclosure are to be conducted by the Contractor. Terminations at the junction box are to be conducted by the Contractor. The UVSS shall supply all cabling. Conduit and conduit runs are to be provided by the installing Contractor.

The enclosures to be located at or in the channel for the UV system shall be rated NEMA 4X and shall be type 304 stainless steel. These panels shall be provided with temperature controls (air conditioning) as necessary (if there are any heat-rejecting components in the panels) to maintain the internal temperature of the enclosure within the acceptable operating range of the provided equipment.

2-2.02. Ballast Distribution Enclosure (BDE). Electrical power supply from the UVSS power panel to the isolation/step-down transformer for each BDE shall be 480 volts, 60 Hz, three-phase, three wire. The BDE shall provide a single point of isolation for a complete UV channel. The BDE shall provide the individual power supplies, with appropriate circuit protection levels, required for the operation of a single channel including, each bank B72E and any auxiliary electrical equipment associated with the channel. The BDE enclosure shall be NEMA 12 rated, to be installed in the conditioned electric room of the UV Building, and shall include ventilation as required to dissipate heat from internal sources.

2-2.03. Isolation/Step-Down Transformer. Isolation/step-down transformers shall be furnished as specified in Section 13700P. The transformer shall provide the required power supply voltage to the BDE.

2-2.04. Ballast 72 Enclosure (B72E). The B72E shall house all the control gear, and electronic ballasts etc., associated with a single bank of UV lamps. The B72E shall have a door-interlocked isolator, which shall be the single point of isolation for the full bank of lamps, enabling simple isolation for safe working on the lamps etc. The door-interlocked isolator shall provide the facility to lock the system off with padlock. Each B72E shall be equipped with a temperature control device, which shall shut off this part of the UV system in case of surpassing the critical limit of 50° C = 122° F. Each B72E shall be equipped with a cabinet heater to prevent the formation of moisture due to humidity and fan-powered ventilation to dissipate internal heat to the conditioned space of the UV Building electric room. The B72E enclosure shall be NEMA 12 rated, to be installed in the conditioned electric room of the UV Building.

2-2.05. Junction Box (JB). The JB shall be NEMA 4X rated and shall be a Type 304 stainless steel unit which spans over the channel and provides all service connections for the associated bank (or banks) of lamps, sensor, position and safety switches, wiper system operation etc. via quick disconnect plug and socket arrangements. The JB shall provide individual termination points for all field cabling and airlines entering the unit. Access to the field terminations inside the JB shall be via a bolted door with weatherproof seal. The construction of the JB shall provide mechanical protection for all cabling and airlines entering the JB.

2-2.06. Electronic Ballasts. Electronic ballast shall drive a pair of lamps with independent control and monitoring circuits, and providing individual lamp status information to the PLC. The ballasts shall be electronic microprocessor controlled, designed as slot cards fitting into a rack system with a plug connector for ease of maintenance. The ballast shall produce an earth free lamp power supply operating at above supply frequency and optimized to preserve lamp life.

The ballast shall incorporate a galvanic separation of the two circuits. In case of the secondary circuit operating in abnormal conditions regarding voltage and/or amperage, the ballast shall shut off the lamp concerned. The ballast shall incorporate a filament pre-heat circuit to minimize lamp failure on startup. The operating power factor for the ballast shall be 0.98.

The configuration of ballast cooling shall include a minimum of two independent forced ventilation systems, to reduce risk of ballast overheating in the event of a single ventilation system failure.

The ballast shall be capable of varying the lamp power between a minimum 50 and 100 percent proportional to a 4-20 mA control signal. The ballasts shall be housed in a fan-cooled NEMA 12 enclosure within an air conditioned electrical room. UVSS shall submit calculations showing that adequate heat load is being removed at the maximum air temperature (90 F).

2-3. INSTRUMENTATION AND CONTROL

2-3.01. Instrumentation and Control. An UV Disinfection Management System shall control the On/Off cycling and lamp power of the UV banks based upon an intensity pacing philosophy. The Management System shall utilize a UV sensor located within the UV bank(s) to accurately sense any change in lamp power, effluent transmittance and compensate for any reduction in the UV-C output due to lamp aging. The UV Disinfection Management System shall receive inputs from the UV sensor and flow meter and shall automatically adjust the received UV dose to maintain the required levels under all operation conditions. In addition to the UV Management System for control, the UV control system shall include a facility to select simple flow pacing which operates on an assumed UV transmittance and end of lamp life power. This alternative control principle shall be selectable via the operator interface via password protection and would normally be set at commissioning.

2-3.02. Instrumentation Control Automation (ICA). The ICA shall be a separate enclosure to house the system PLC, operator interface, control and instrumentation equipment and plant interface termination points. Electrical power supply to the ICA shall be a single 120 Volts/60 Hz/1 phase supply. The ICA shall have an internal single point of isolation and house any power distribution circuits, transformers or power supplies for the UV system requirements.

PLC's supplied as part of this project shall be as specified in Section 13530. The PLC shall be capable of exchanging data with the Plant Control System (PCS) through the plant's data communication network. As described in Section 13700P, the PLC data registers shall be made available to the System Integrator for incorporation into the overall PCS. An Operator Interface Terminal (OIT) shall be mounted in the PLC cabinet door. System operating information shall be displayed on the OIT in both color graphic and text format.

As a minimum, the system shall display and transmit the alarms listed in 13700P. Low UV intensity alarms shall be provided to detect possible water quality problems or fouling of the system. Alarm set points shall be field adjustable. Individual lamp status information shall be monitored by the PLC and displayed on the operator interface. Such information shall include the following:

Individual lamp On/Off status.
Bank running hours.
Bank On/Off cycles.

Single and multiple lamp failures shall initiate appropriate alarms.
The PLC shall monitor the wiper system "end of travel" position switches to determine system fouling, etc. The PLC shall monitor hardwired protection circuits, e.g., Module lifted, Module unplugged, Module over current, Bank isolation, etc., which shall shut the appropriate area of plant down directly, to aid rapid fault finding when personnel attend site. In case of a PLC failure and the system turned to manual mode, all safety protection circuits shall remain operational. UV systems, which do not provide this feature, shall not be acceptable.

2-3.03. On-Line Remote Diagnostics. The System shall include the capability for remote diagnostics by the UV system supplier (UVSS). If necessary, remote diagnostics by a UVSS technician will be through a dedicated telephone line modem connection terminated in the SCC. The modem may be enabled/disabled at the SCC by plant personnel upon request.

2-4. CLEANING SYSTEM

2-4.01. Cleaning System. Each UV module shall be equipped with an automatic wiping system with selectable wiping frequency and number of strokes. The automatic wiping system shall be pneumatically powered and shall use teflon wipers to clean the quartz sleeves. Wiping frequency shall have an adjustable number of strokes and an adjustable timer interval.

The total wiper holder assembly shall not shadow more than 0.75 inch of lamp length area at any time. Systems which shadow more than 0.75 inch of lamp

length or arc at any given time shall have the lamp output watts derated by a proportional amount of wiper length to lamp arc length to account for the shadow or covering of the lamp by the wiper during operation.

The wiping system shall be PLC controlled and provide a fully automatic, unattended operation. Wiping interval, the time between wiping cycles, shall be factory preset at optimum value based on water condition and shall be easily reset by the Owner whenever actual conditions warrant. Interval range shall be typically 1 to 120 minutes. The number of wiping strokes per interval shall be factory preset for optimum effect and shall be easily reset by the Owner from 1 to 5 strokes per interval. The useful life of the wiper brush or cleaning device in contact with the quartz sleeve shall be in excess of 12,000 hours based on factory stroke and interval settings.

The cleaning system shall maintain uniform wiping tension and cleaning over complete wiping length of the quartz sleeve and the UV sensors. The cleaning system shall maintain full efficiency throughout its life, with no deterioration in quality of cleaning.

The wiper blade brush or other cleaning device in contact with the quartz sleeve shall be nonmetallic and shall not damage or scratch the quartz sleeve or sensor in any way. To offset cleaning mechanism wear and to maintain positive contact and wiping efficiency with the quartz sleeve, the wiper blade brush or other cleaning device shall be self-adjusting and shall automatically adjust to account for wear over its useful life. Systems that require manual adjustments for operation or to maintain cleaning efficiency on the sleeve are not acceptable.

The wiped length of the quartz sleeve shall be not less than 56 inches or the complete arc length whichever is greater.

The wiping system air lines shall be quick connect type and shall not require the separate connection/disconnection of compression type fittings for installation or removal of the module from service. Each airline connector in the quick disconnect plug and socket shall have an integrated check valve so that, upon removal of a module from service, system pressure is maintained. A self-contained compressor package rated for 7.0 scfm at 65 to 100 psig, with suitable sized receiver tank and all installation and control equipment shall be furnished for the automatic wiping system. Airflow is only required during the wiping cycle(s).

For systems not using chemical cleaning, an out of channel cleaning system shall be supplied. This cleaning system shall include lifting slings, cleaning tanks, agitation system and air compressors as required by the equipment supplied.

to allow cleaning of one bank at a time. The UVSSshall be responsible for supplying all equipment including any equipment not specifically listed that is required to perform out of channel cleaning, except for the lifting crane.

End of Section

Section 13703P

LOW PRESSURE HIGH OUTPUT UV REACTORS
ALTERNATIVE C

PART 1 - GENERAL

1-1. SCOPE. This section covers the design requirements, materials, product data, start-up, commissioning, and performance testing for low-pressure high output (LPHO) UV Reactors.

The UV System Supplier (UVSS) shall provide the required information to the Owner and its Engineer as required for the design of facilities associated with the Arrowhead Ranch Water Reclamation Facility (ARWRF) UV Replacement Project.

It is the intent of this specification to establish minimum equipment and quality standards for the UV disinfection system. It is the UVSS responsibility to coordinate with the selected Contractor and together provide all parts, equipment, materials, and components required for a complete and functional system, including any performance testing.

The equipment furnished under this alternative shall be the Aquaray 40 HO as manufactured by IDI/Ozonia. Equipment provided shall meet the requirements of Section 13700P - GENERAL UV SYSTEM REQUIREMENTS, Section 13704P - UV SYSTEM PERFORMANCE AND VALIDATION TESTING and all constraints described in this specification. Any exceptions or deviations from this specification or others shall be clearly document in the UVSS Bid Form.

PART 2 - PRODUCTS

2-1. CONSTRUCTION

2-1.01. UV Lamps. Lamps shall be low pressure, high-output type. Each lamp shall produce UV light with at least 90 percent of the UV emission at 253.7-nanometer wavelength. Lamps shall be low pressure mercury slimline of hot cathode instant start design, in which the coiled filament cathodes are heated by the arc current. The filament of the lamps shall be clamped design and shall be significantly rugged to withstand shock and vibration. The electrical connections to the lamps at shall be a non-proprietary pigtail with molded 2-wire connector. The rated UVC lamp output shall be approximately 52.0 UVC watts.

The lamp intensity at a distance of 1 meter in air shall be 370 microwatts/ cm^2. Minimum lamp arc length shall be 62 inches. Lamps shall not produce any ozone. Lamp bases shall be of durable construction resistant to UV. The lamp design shall prevent electrical arcing between electrical connections under moist conditions. The power consumption of the system per lamp shall not exceed 172 watts. The lamp array configuration shall be vertical, with a uniform staggered array, with all lamps parallel to each other and perpendicular to the flow. Lamps shall be spaced in vertical rows with centerline spacing.

2-1.02. UV Lamp Sleeves. UV lamps shall be protected from contact with the effluent by a 99.9 percent silicon dioxide quartz jacket with a minimum of 90 percent transmission of UV radiation at the 253.7-nanometer wavelength and shall have a nominal wall thickness of 1.0 mm.

One end of the quartz jacket shall be a closed test tube end and the other open with smooth radius edges.

2-1.03. UV Modules. Each vertical UV module shall be precision fabricated in Type 316L stainless steel to meet NEMA-4X standards. The lid shall include six individual latches and clamp against an internal gasket. Four support legs shall connect the module enclosure to a bottom pan. Systems, which use bolted or hinged subassemblies of dissimilar metals such as aluminum or which cannot meet NEMA-4X standards shall not be acceptable.

Each module shall be field serviceable while located in the channel and shall be fitted with water resistant UL rated multi-pin connectors for power and data.

Each module shall be equipped with lifting lugs to allow for the attachment of a lifting spreader so that the modules or banks of modules can be easily lifted with the overhead monorail system.

Automatic interlock protection shall be incorporated into each module enclosure such that while the module enclosure lid is open, power to lamps shall be automatically shut off.

Each module shall be identified by electronic serial number that is easily accessible.

Each UV module shall be designed for complete submergence at water depth of 6 feet above modules without causing failures or damage to the system or components for 24 hours. Modules shall not contain any components, such as electronic cards, that cannot withstand complete submergence.

Each module shall be equipped with motor driven mechanical wipers capable of operation in manual or automatic modes. The cleaning wipers shall be automatically initiated and controlled from the operator interface. Intervals for the

cleaning cycle shall be adjustable in the field from once per day to once per week. Each module shall be provided with an independent cleaning system. The cleaning system shall be actuated by an AC motor housed within the module. All required monitoring and control components shall be housed in the module so that each is independently operated, requiring only an initiate cycle command from the main controller.

The mechanical wipers shall be fabricated of UV resistant material and installed in a manner which accommodates any irregularities associated with the quartz sleeves and precludes any binding during operation. Wipers shall be replaceable without having to dismantle the wiper drive system, complete removal of the quartz sleeves, or disassembly of the module structure. Wipers shall normally be parked above the water surface elevation when not in use. The wiper system shall be mechanically driven with a single drive assembly, which incorporates a centrally located means of supporting and aligning the wipers properly throughout the travel. The wipers shall travel the full length of the lamp sleeves. Designs in which the wipers only travel part way along the sleeves shall not be acceptable.

Each UV lamp module shall be equipped with flow dispersion baffles to create better mixing and a more uniform UV intensity field within the reactor. The baffles shall be an integral part of the UV lamp module housing 40 low pressure high output ultraviolet lamps. The baffle material shall be Type 316L stainless steel.

2-2. ELECTRICAL. A power distribution center panel (PDC) shall be provided for each channel. The PDC's shall be installed in the conditioned electric room of the UV Building. Each PDC enclosure shall be fan-cooled NEMA Type 12. The UVSS shall submit calculations proving that adequate heat load is removed at the maximum air temperature (110°F).

The power supply brought to the PDC's shall be derived from the isolation/step-down transformers specified in Section 13700P.

Where applicable, pneumatic tubing within the PDC shall be 1/4 inch OD, soft annealed copper with compression fittings. Tubing and fittings shall be as specified in the miscellaneous piping section.

Compression type bulkhead fittings within the PDC shall be provided near the bottom or the top of the panel for all field connections. Compression nuts and sleeves shall be provided for field connections. Indicators, recorders, controllers, and other pneumatic devices shall be provided with plugged test connections and shutoff valves for isolation.

Where applicable, all devices within the PDC shall have separate air supply shutoff valves. Valves and compression fittings shall be as manufactured by Nupro, Parker Hannifin, Swagelock, Tylok, or Whitey.

All internal instrument and component device wiring within the PDC shall be as recommended by the UVSS. Operator interface terminal (OIT) and indicating light circuits shall be minimum 16 AWG. Electronic analog circuits shall be 16 AWG twisted and shielded pairs rated not less than 300 volts. Analog circuits shall be separated from AC power circuits.

Each PDC shall consolidate all power, instrumentation and control functions for each UV module. The PDC panel cabinet shall be suitable for floor mounting on integral legs, minimum size 36 inches wide by 60 inches tall by 12 inches deep. The PDC cabinet shall be lockable. The panel shall be of adequate size to contain all power and control functions.

All wiring shall enter and exit the PDC through the bottom. The PDC shall be provided with a main circuit breaker disconnect inside the panel. The circuit breaker disconnect shall be furnished with an operating handle on the external side of the panel that can be locked in the open position. Panel wiring shall be neatly organized, color coded, routed and labeled. Numbered terminal strips shall be used to terminate wires and shall be coordinated with module numbering. The PDC shall be provided with adequate lighting and four, 120 volt power receptacles inside the panel. Each UV Lamp module shall be protected by a panel mounted thermal magnetic circuit breaker device. These circuit breakers shall be mounted in the PDC. Each circuit breaker shall provide visual trip indication and be capable of regular testing.

All electrical components, wiring, and controls on or within the disinfection system as a whole shall be designed, constructed and supplied by the UVSS as part of this Contract and in accordance with the current edition of the National Electrical Code and all applicable state and local electrical codes. The UV system modules shall be completely wired, requiring only external connection of power and data cables.

Electrical wiring installed between the PDC and the UV channels shall be concealed to the extent practicable. The Contractor shall be responsible for coordination and the installation of conduit in the concrete slab prior to the pouring of the concrete slab for the new UV channels.

Manufacturer shall incorporate ground fault circuit interrupters into its overall system design at all points necessary to provide maximum safety.

2-2.01. UV Module Enclosures. Each vertical UV module shall consist of UV lamps with an integral NEMA Type 4X enclosure. The quartz jackets which

penetrate the enclosure bottom shall each be sealed from water penetration by an individual compression gasket assembly. The design of the enclosure shall be suitable for individual lamp replacement in place. Power to lamps shall be

automatically interrupted when the enclosure door is opened. Panel wiring shall be neatly organized, color coded, routed and labeled. Numbered terminal strips shall be used to terminate wires and shall be coordinated with lamp numbering. Panel components shall not inhibit individual lamp replacement. All materials used shall be highly resistant to UV light. Ballasts shall be neatly mounted in the cabinet using plug in/out type connectors. The enclosure shall be fitted with a waterproof, UL-approved, multipin connector(s) which can be easily disconnected when the module is to be removed from the channel for cleaning.

Each of the channels in which modules are to be installed shall be provided with electrical wire way, electrical wiring, and multipin connectors the entire length of the channel for module installation.

UV modules shall be uniquely identified by the control system electronics regardless of where a module is placed in the channel.

Eye shields shall be provided adjacent to each module. Shields shall be stainless steel.

2-3. INSTRUMENTATION AND CONTROL

2-3.01. Control and Instrumentation. All instrumentation used in the UV disinfection system for control or monitoring shall be individually fused or circuit breaker protected to minimize the effects of any single point of failure. All instrumentation shall be designed for use in the application for which the UV system is using it. All instrumentation shall be installed as per UV system supplier instructions.

2-3.02. System Control Center (SCC). The SCC shall be provided as specified in Section 13700. UV system control and monitoring shall be provided through an Operator Interface Terminal (OIT) to allow complete operator interface and control. Hardwired panel devices and meters shall not be permitted. OIT will be provided as specified in Section 13530.

PLC's supplied as part of this project shall be as specified in Section 13530. The PLC shall be capable of exchanging data with the Plant Control System (PCS) through the plant's data communication network. As described in 13700, the PLC data registers shall be made available to the System Integrator for incorporation into the overall PCS. An Operator Interface Terminal (OIT) shall be mounted in the PLC cabinet door. System operating information shall be displayed on the OIT in both color graphic and text format.

2-3.03. Electronic Lamp Controllers (ELC). Each module shall include one high performance electronic lamp controller for each pair of UV lamps. The ELC shall be designed for use with the specified UV lamps.

Each ELC shall include a ballast sense feature, which shall continuously monitor the operating state of the ballast. This signal shall be capable of generating an alarm in the event of a fault with the ELC. This feature must be provided without exception.

The ballast shall be specifically designed to power two UV germicidal low-pressure high output lamps with a UVC output of not less than 52 watts.

With two lamps operated, ballast draw shall not exceed 172 watts per lamp at operating voltage of 230 volts.

Ballasts shall power the UV lamp to produce lamp-output of a minimum of 370 microwatts/cm^2 UV at a distance of one meter in air.

Separate ballast enclosures, if used, must meet UL/NEMA 4X specifications. Force ventilated enclosures which permit introduction of outside air shall not be acceptable unless equipped with an active air filtration system or an automatic signal to advise operators when replacement of filter is required.

2-3.04. UV Module Holder. A UV module holder shall be provided. The module holder shall be Type 316 stainless steel with the ability to support a module support rack for cleaning and maintenance. Module holder shall be fixed type.

2-4. CLEANING SYSTEM

2-4.01. Cleaning System. Each UV module shall be equipped with an automatic wiping system with selectable wiping frequency and number of strokes. The automatic wiping system shall be electrically or pneumatically powered and shall use UV resistant nylon wiper brushes to clean the quartz sleeves. Wiping frequency shall have an adjustable number of strokes and an adjustable timer interval. The total wiper holder assembly shall not shadow more than 0.75-inch of lamp length area at any time. Systems which shadow more than 0.75-inch of lamp length or arc at any given time shall have the lamp output watts derated by a proportional amount of wiper length to lamp arc length to account for the shadow or covering of the lamp by the wiper during operation.

The wiping system shall be PLC controlled and provide a fully automatic, unattended operation. Wiping interval, the time between wiping cycles, shall be factory preset at optimum value based on water condition and shall be easily reset by the Owner whenever actual conditions warrant. Interval range shall be typically 1 to 120 minutes. The number of wiping strokes per interval shall be factory preset for optimum effect and shall be easily reset by the Owner from 1 to

5 strokes per interval. The useful life of the wiper brush or cleaning device in contact with the quartz sleeve shall be in excess of 2 years based on factory stroke and interval settings. The PLC shall monitor the wiper system "end of travel" position switches to determine system fouling.
The cleaning system shall maintain uniform wiping tension and cleaning over complete wiping length of the quartz sleeve and the UV sensors. The cleaning system shall maintain full efficiency throughout its life, with no deterioration in quality of cleaning. The wiper blade brush or other cleaning device in contact with the quartz sleeve shall be non-metallic and shall not damage or scratch the quartz sleeve or sensor in any way. To offset cleaning mechanism wear and to maintain positive contact and wiping efficiency with the quartz sleeve, the wiper blade brush or other cleaning device shall be self-adjusting and shall automatically adjust to account for wear over its useful life. Systems that require manual adjustments for operation or to maintain cleaning efficiency on the sleeve are not acceptable.

The wiped length of the quartz sleeve shall be not less than 56 inches or the complete arc length whichever is greater.

An out of channel, to serve as a back-up cleaning system, cleaning system shall be supplied. This cleaning system including lifting slings, removable banks, cleaning tanks, agitation system and air compressors will be supplied. The UV system supplier will be responsible for supplying all equipment including any equipment not specifically listed that is required to perform out of channel cleaning.

End of Section

Section 13704P

ULTRAVIOLET DISINFECTION SYSTEM
PERFORMANCE TESTING

PART 1 - GENERAL

1-1 SCOPE. This section covers the performance testing for a UV disinfection system specified elsewhere in the Contract Documents.

1-2 GENERAL

The UV System Supplier (UVSS) shall guarantee that the UV system, including all equipment as specified herein and all ancillary equipment, is capable of achieving inactivation of microorganisms equivalent to that achieved using a germicidal UV design dose without exceeding the Guaranteed Present Worth Cost as stated by the UVSS in the Request for Proposal. Performance tests shall be conducted based on conditions for flow, UV transmittance, and dose as specified, and considering degradation such as equipment aging and wear, fouling, and cleaning efficiency.

1-3 PERFORMANCE TESTING

The UVSS shall be required to complete several required tests. These tests shall include:

1. Factory Testing.
2. Functional Testing.
3. Performance Testing.

1-3.1 Factory Witness Test:

The UVSS shall be responsible for the Factory Witness Test that shall be conducted after the equipment has been fabricated and before system is shipped to the site. The UVSS shall coordinate the schedule for the test through the Owner, Engineer and Contractor. The Owner or his representative may attend this test at their cost. The UVSS shall provide a minimum of 14 days advance notice to the Owner and Engineer prior to commencing the test.

All major system components of the UV System shall be tested in a single factory test session for compliance with the contract documents and functional requirements specified herein.

The UVSS shall submit a Factory Witness Test Plan, for approval, to the Engineer that shall demonstrate the full operability of UV System with the shop

drawings. The test plan shall include, but is not limited to the testing of the delivery of the UV dosage, the intensity sensors, local control panel for each of the chambers, and the instrumentation and controls for each of the chambers, and operator interface units. The scope of the Factory Witness Test shall demonstrate that each of the individual UV Systems operates as specified.

Upon conclusion of the Factory Witness Test, the UVSS shall submit a Factory Test Report discussing the tests performed and the results for the approval of the Engineer and Owner.

The UV System shall not be shipped until the Factory Test Report is approved by the Engineer.

1.3.2 Functional Testing:

The first element of the required testing fetr installation has been approved by the UVSS shall consist of Functional Testing for all UV reactors. For Functional Testing, the UVSS shall verify operation of all system components, all control system functions, all system alarms, and communication links. The Functional Testing shall also include verifying the operation of the control system for local and remote operation. The lamp output shall be changed to verify that the sensor outputs are sufficiently sensitive to pick up the decrease in UV intensity. Functional testing shall demonstrate impacts of loss of UV transmittance signal and flow rate signal.

The UVSS shall inspect the installed UV System for proper alignment, correct operation, proper connection, and satisfactory function of all components. All signals shall be verifled, and all alarms shall be tested. The UVSS shall approve the installation and provide written certification that the system components have been installed properly, and are ready for operation. The UVSS shall notify the Engineer and Owner of the Functional Testing schedule at least three weeks in advance to allow the Engineer and Owner to witness testing.

The proposed Functional Testing procedure/plan shall be developed by the UVSS, submitted to the Engineer and Owner during the shop drawing review period, and reviewed by the Owner and Engineer. The UVSS shall notify the Engineer and Owner at least 3 weeks before scheduling and performing Functional Testing.

1.3.3 Performance Testing:

The Performance Testing shall include testing for microbial inactivation, validating the specific power consumption and power factor of the UV system, and verifying the specified headloss across the UV reactors. The Performance Test shall proceed for a minimum of 3 days and will continue until such time that all required data is collected.

Performance Testing shall be completed on a representative number of banks/modules in each UV channel. The Performance Testing procedure shall be based on the spot-check approach accepted by California DPH and shall be developed by the UVSS, submitted to the Engineer and Owner during the shop drawing review period, and reviewed by the Engineer and Owner before scheduling Performance Testing. The UVSS shall contract a third party to conduct the testing. The third party tester shall have an Arizona PE. Third party shall be Vic Moreland of the University of Hawaii or someone of similar qualification, subject to approval by the Owner and Engineer.

1.3.3.1 Spot-Check Bioassay Performance Testing

Immediately prior to beginning microbial inactivation testing, quartz sleeves shall be hand cleaned and cleaned with the automatic wiper system. Measurements shall be taken of the reactor to confirm the size and dimensions of the reactor. Testing shall be conducted at the minimum design UVT, design flow rate per UV reactor, end of lamp life and fouling factor, and UV dose of 120 mJ/cm2. Minimum UVT shall be simulated by adding a UVT reducing compound (e.g., sulfonic acid/Super Hume). UVSS is responsible for identification of appropriate monitoring locations (i.e. at a minimum 7 pipe diameters up steam of the reactor and 5 pipe down stream). The Contractor shall be responsible for the installation of any required injection and sampling taps/locations required by the UVSS for testing to occur. Actual monitoring locations identified in the field shall be confirmed using a mixing study, which will be completed before any spot check bioassay testing is complete. End of lamp life and fouling factors shall be simulated by adjusting the output of the UV lamps. Procedures for this simulation shall be included in the Performance Testing Procedure. Power consumption monitoring will also be completed of this testing. Testing water shall not contain any disinfectant residuals. UVT and lamp output adjustments shall be the responsibility of the UVSS.

At least three concurrent pairs of influent and effluent samples shall be taken by the UVSS at each test condition (minimum of 10 test conditions). Samples shall be analyzed for test organism MS2 (influent and effluent), turbidity, and UV transmittance. Additional data required including but not limited to flow will also be collected by the UVSS. Individuals collecting samples shall be trained in collection of microbial samples. At the same time samples are collected, date/time, flow, number of lamps operational, lamp intensity, lamp age, ballast age, power use, number of reactors in operation, water temperature, and head loss shall be recorded.

The UVSS shall have all microbial samples analyzed by an independent, certified, Owner-approved testing laboratory. All other data collection and analyses shall be performed by the UVSS. The UVSS shall be responsible for costs for all data collection and analyses. Collimated beam analysis shall be done each day of sampling. The MS2 inactivation curve from the on-site testing shall be determined using methods consistent with the 2003 NWRI requirements.

Chow test samples shall be performed to test to see if the curves/data can be combined into a single set. If not, the most conservative inactivation curve for the day of testing shall be used for data generated from samples of that day.

Sample collection may commence after flow and UVT have stabilized for approximately 15 minutes or a minimum of 3 retention times as determined by a mixing study. All laboratory tests necessary to demonstrate compliance with the performance testing requirements shall be performed in conformance with the applicable portions of the most recent edition of the Standard Methods for the Examination of Water and Wastewater. If a retest is required, the UVSS shall be responsible for all subsequent sample collection and laboratory tests at no additional cost to the Owner.

A test report shall be prepared that shows that the results of the spot check-bioassay results are within the confidence described in the 2003 NWRI guidelines for the Design of UV systems using the lower 75th log inactivation for each test run. 8 out of 10 samples must achieve the required RED within the lower 75th log inactivation.

If during Performance Testing the UV System fails to satisfy the specified log reduction requirements at the stated power consumption, the UVSS shall make, at no additional cost to the Owner, such adjustments and modifications that are necessary to correct the system, and demonstrate limits can be met by repeating testing.

Performance testing of the UV disinfection units shall be completed before the date of substantial completion specified in the Agreement. Tests shall be conducted after the lamps have completed a minimum 100 hour burn-in period. The UV reactors shall be manually operated as needed before testing to meet this requirement.

Performance tests shall be conducted at a time selected by the Owner and mutually agreed to by the UVSS. The Owner will cooperate with the manufacturer during start up to provide the wastewater effluent to the UV system. The Owner will operate the facilities such that specified flow conditions are approximately simulated to each UV channel. All reasonable efforts will be made by the Owner to approximate steady-state flow conditions for the duration required to allow samples to be taken.

The performance tests shall be under the direct supervision of Vic Moreland Consulting or other qualified UVSS field representative. The UVSS representative shall have previous satisfactory experience in conducting tests of the type specified. All costs for subsequent trips by Vic Moreland and/or the UVSS's field representative for the purpose of modifying and retesting the UV equipment shall be solely at the expense of the UVSS, provided the retests are required due to the function of the UV system.

The UVSSshall prepare a report on the test results. Five copies of the report shall be submitted to the Engineer. The information collected will be used as a basis for determining acceptability of the UVSS's results. In case of conflict, interpretations and calculations made by the Engineer will govern.

In addition to the performance testing, The UVSS will pay for verification of end of lamp life values through testing at 2,000, 4,000, 6,000, and 8,760 hours. Two representative lamps from each reactor will be removed and sent to the UVSS for testing. Testing will be conducted to verify the rate under which the UV lamp output is decreasing. A penalty will be imposed if the results of end of lamp life testing is less than the end of lamp life factor used by the UVSS in the warranty of the UV system.

1.3.3.2 Fouling Study

As part of this contract, the UVSS will perform fouling of quartz sleeve testing to confirm the fouling factor used in the warranty. The UVSS will pay for testing at 2,000, 4,000, 6,000, and 8,760 hours. Two representative quartz sleeves from each reactor will be removed and sent to the UVSS for testing. Testing will be conducted to verify the rate under which the quartz sleeve UV output is decreasing. The short term fouling study shall be performed by the UVSS to demonstrate the sleeve fouling factor specified in Section 13700P or better is maintained. UVSS shall record UV intensity, UV lamp power and UV transmittance at intervals to be determined. Prior to performing the study, the sensor sleeve shall be manually hand cleaned. Sensor values shall be recorded at 100% lamp power along with UV transmittance. A specified time interval for sensor measurement shall be established after cleaning frequency is programmed into the UV system. A minimum of 40 data points shall be generated during the fouling study. All sensor data shall stay above the specified fouling factor value (including sensor uncertainty) at time zero for matching UV transmittance values. The lamp power shall be fixed at 100% output during the entire fouling study. If any measurements show less than the quartz sleeve factor stated by the UVSS during testing, the UVSS shall be required to perform additional testing to determine the number of sleeves with lower fouling factors than the UVSS guaranteed to the satisfaction of the Owner. Upon completion of testing, the UVSS shall be required to replace all sleeves with lower than specified values. In addition, a 6 month fouling study shall be conducted at the UVSS's expense to verify the actual fouling factor of the quartz sleeves supplied for this project.

1.3.3.3 30 Day confirmation testing

At the completion of the spot check bioassay the system shall be operated for 30 days at the average design conditions. All costs of the 30 day testing shall be the responsibility of the UVSS. Total coliform analysis shall be completed on the influent and effluent to the UV system. The UV Disinfection System shall be defined as meeting the Performance Testing Requirements with regard to

microbial inactivation if 4 out of 7 Total coliform samples collected during Performance Testing is less than detection for fecal coliforms. No single sample shall be greater than 23 CFU/100 ml. All values whether below the maximum single sample limit that result in detection shall be reported during the testing period. In addition, power monitoring shall be conducted during this 30 day period to verify the electrical output of the system. If during Performance Testing the UV System fails to satisfy the specified total coliform reduction requirements, the UVSS shall make, at no additional cost to the Owner, such adjustments and modifications as are necessary to correct the system, and demonstrates satisfactory performance by repeating testing.

Samples shall be collected by the Contractor under supervision of the UVSS daily during the test period.

Performance tests shall be conducted at a time selected by Owner and mutually agreed to by the UVSS. The Owner will cooperate with the UVSS during start up to provide the wastewater effluent to the UV system. The Owner will operate the facilities such that specified flow conditions are approximately simulated to each reactor. All reasonable efforts will be made by the Owner to approximate steady-state flow conditions for the duration required to allow samples to be taken.

The performance tests shall be under the direct supervision of the UVSS. The UVSS's representative shall have previous satisfactory experience in conducting tests of the type specified. All costs for subsequent trips by the UVSS's field representative for the purpose of modifying and retesting the UV equipment shall be solely at the expense of the UVSS, provided the retests are required due to the function of the UV system.

Sample collection shall be directed by the UVSS's field representative and performed by an independent, certified, Owner-approved laboratory engaged by the UVSS. The UVSS shall coordinate with laboratory personnel to collect, preserve, and transport the samples to the laboratory; conduct the required analyses, and report the results. Chain of custody procedures shall be followed using a custody form acceptable to the Owner. The UVSS shall pay for all specified testing and shall be responsible for making all necessary arrangements with the laboratory.

The UVSS's field representative shall prepare a report on the test results. Five copies of the report shall be submitted to the Engineer. The information collected will be used as a basis for determining acceptability of the UVSS's results. In case of conflict, interpretations and calculations made by the Engineer will govern.

In addition, the following data shall be collected on the UV system influent sample on the first day of testing:

pH.

Hardness.

Calcium.

Total dissolved solids (TDS).

Iron.

Water temperature.

Electrical power consumption shall be measured and recorded continuously over the performance test in order to provide verification of the power consumption of the UV system. Power consumption shall be measured by a temporary recording watt meter or data logging system provided, maintained and operated by the UVSS. Test reports for each of the 30 days shall be generated and shall include a plot of system power consumption (kWh operating and kW demand), versus flow rate (mgd) on 5 minute intervals during the previous 24 hour period.

Data recorded shall be provided to the Engineer in electronic format in addition to traditional paper copies.

1-3.02. Sample Analysis. The UVSS shall have the samples analyzed by an independent, certified, Owner-approved testing laboratory. Sample collection, preservation, and analysis shall be in accordance with the procedures described in the latest edition of "Standard Methods for the Examination of Water and Wastewater" and 40 CFR Part 136 procedures for effluent testing. In any event, the temperature of samples shall be held below 4°C during a maximum transport time of 2 hours. Samples shall be refrigerated upon receipt in the laboratory and processed within 2 hours.

1-3.03. Modifications.

1-3.03.01. First Retest. If the UV disinfection units fail to satisfy the specified log removal or fecal coliform reduction requirements, energy consumption values, dose verification, fouling factor, or head loss, the reactors shall be modified as required to produce an installation which will satisfy the requirements. After modifications, the equipment shall be completely retested as indicated in this Section.

Modifications shall be provided and all retesting shall be performed at no additional cost to the Owner. This includes payment of all engineering fees and expenses associated with Owner's and Engineer's observation of the retests. All structural or electrical modifications necessary to accommodate the modified equipment shall be made solely at the expense of the UVSS.

1-3.03.02. Second Retest. If the UV disinfection units fail in the First Retest to meet the specified requirements, the units shall again be modified and retested in accordance with the requirements of this Section. Modifications shall be provided and all retesting shall be performed at no additional cost to the Owner. This includes payment of all engineering fees and expenses associated with Owner's and Engineer's observation of the retests. All structural or electrical modifications necessary to accommodate the modified equipment shall be made solely at the expense of the UVSS.

The Owner may, at his option, may allow the UVSS to make additional modifications and retests, all of which will be at no additional cost to the Owner. Any subsequent modifications and testing will be at the cost of the UVSS. Should the UV system continue to fail to meet the requirements of the performance testing the Owner may take the following courses of action:

a. Allow the UVSS to make additional modifications and retests. All costs associated with witnessing retests shall be at the UVSS expense including but not limited to time and expenses for Engineering and Contractor personnel.

b. In addition to the modifications, liquidated damages may be assessed and levied at the discretion of the Owner if the noncompliance is faulty equipment or negligence on the part of the UVSS. These damages will be based on the present worth of the difference between the power requirements submitted by the UVSS in their bid package and what was measured during the performance test. Liquidated damages for power will be assessed at a rate of $0.10 per kilowatt-hour exceeding the value submitted per day x 24 hr/day x 365 days/year. Additional liquidated damages of 2 man hours @ $60/hr per week will be imposed to account for increased maintenance. Power and maintenance costs on a yearly basis will be multiplied by a 20 year present worth factor of 12.46. The resultant value represents the penalty for underperformance that the Owner will incur over the 20 year system life cycle.

c. Should the UV system fail to meet the UVSS's maximum head loss provided in the bid package all necessary system upgrades including but not limited to channel modifications, weir modifications, etc. shall be supplied at the UVSS's expense. If additional equipment is required, such as pumps, etc. the UVSS shall purchase the equipment and pay for all installation costs. Further the UVSS shall be responsible for all power costs associated with operation and maintenance of the additional equipment for the duration of the 20 year life cycle calculated similarly to that shown in item b above. Man hours for equipment maintenance will be based on 2 man hours per week @ $60.00/hr.

d. Reject the equipment and require the UVSS to remove all equipment from the site, with the UVSS refunding all payments received and compensating Owner for cost of a replacement system and any resulting construction costs required for the replacement system.

End of Section

Section 15114

OPEN-CHANNEL SLIDE GATES AND WEIR GATES

PART 1- GENERAL

1-1. SCOPE. This section covers furnishing slide gates and actuators as specified herein. Slide gates shall be furnished complete with frames, slides, seals, actuators, operating stems, and appurtenances as specified herein, as indicated in the schedule and as specified in the General UV Requirements section.

1-2. GENERAL. Equipment furnished under this section shall be fabricated and assembled in full conformity with Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

Gates and actuators shall be furnished with all necessary parts and accessories indicated on the Drawings, specified, or otherwise required for a complete, properly operating installation and shall be the latest products of a manufacturer engaged in the production of slide gates.

1-2.01. General Equipment Stipulations. The General Equipment Stipulations shall apply to all equipment furnished under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

1-2.02. Governing Standard. Except as modified or supplemented herein, all slide gates shall conform to the applicable requirements of ANSI/AWWA C513.

1-2.03. Identification. Slide gates shall be tagged as specified in the General Equipment Stipulations section.

1-3. SUBMITTALS. Complete drawings, construction details, and specifications covering the slide gates and appurtenances shall be submitted in accordance with the Submittals section. Each drawing shall be identified with the slide gate designation.

Drawings shall include separate wiring diagrams for each electrically actuated gate and related electrical control equipment.

1-4. DELIVERY, STORAGE, AND HANDLING. In addition to the requirements specified in the Shipping section, frames shall be provided with corner bracing, plywood sheet backing, or other means to hold the frames in proper alignment during shipment and installation. The bracing or backing shall be factory applied

and shall not be removed until after the frames have been installed in the structures.

PART 2- PRODUCTS

2-1. SERVICE CONDITIONS. All slide gates and weir gates supplied under this project will be located in a climate controlled building. Process fluid is tertiary treated effluent.

2-2. PERFORMANCE AND DESIGN REQUIREMENTS. Slide gates shall be designed for the conditions and requirements indicated in the Slide Gate Schedule.

2-2.01. Design. Liberal factors of safety shall be used throughout the design, especially in the design of parts subject to intermittent or alternating stresses. In general, working stresses shall not exceed one-third of the yield point or one-fourth of the ultimate strength of each material.

Gates shall be designed for the seating and unseating heads indicated in the Slide Gate Schedule.

Gates shall be designed to fit into the structures indicated on the drawings.

2-3. ACCEPTABLE MANUFACTURES. For slide gates acceptable manufactures are Golden Harvest, Hydro Gate, M&H, Rodney Hunt, and Whipps.

2-4. MATERIALS.

Frames, Guides, Slides, Reinforcing Members, and Yoke Beams	Stainless steel, ASTM A-276, 304L or 316L.
Flush Bottom Closure Seal	Compressible neoprene.
Hollow Bulb J-Seals	Compressible neoprene.
Seal Retainer Bar	Aluminum, ASTM B211 or B221, Alloy 6061-T6.
Slide Seats and Bearing Bars	UHMW polyethylene.
Operating Stems	Stainless steel, AISI Type 304 or 316.
Assembly Fasteners	Stainless steel, AISI Type 302, 303, or 304.

Epoxy Enamel	PPG-Amercoat "Amercoat 385 Epoxy", Carboline "Carboguard 890", Sherwin-Williams "Macropoxy 646" or Tnemec "Series N69 Hi-Build Epoxoline II".
Epoxy Enamel (NSF Certified Systems)	PPG-Amercoat "Amerlock 400 High-Solids Epoxy Coating", Carboline "Carboguard 891", Sherwin-Williams "Macropoxy 646NSF" or Tnemec "Series N140 Pota-Pox Plus"; immersion service.

2-5. CONSTRUCTION.

2-5.01. Frames. Each frame shall be an integral unit of extruded or welded structural shapes at least 1/4 inch [6 mm] thick. Frames shall be designed for embedment in concrete or installation on the face of concrete walls as indicated on the drawings. Embedded frames shall be recessed so that the waterway is not obstructed.

Guides shall be provided on each side of each frame. Guides shall be sufficiently strong to require no further reinforcing where they extend above the operating floor, and shall support the entire height of the slide in all positions.

Full-length plastic slide seats or bearing bars shall be provided on the downstream side of the slide on gates subject to seating pressure from one direction. Gates subject to seating pressure from either direction shall be provided with plastic seats or bearing bars on both faces of the slide. Seats and bars shall be securely held in the guides by dovetail or "T" grooves in the frame.

Self-contained gates shall be equipped with a yoke, shop welded to the top of vertical frame members to support the actuator. Yokes shall be fabricated from a pair of rolled or extruded channels or angles and shall be designed to deflect not more than 1/360 of the span when the gate is operated at the maximum actuator thrust with the safety factor as indicated in the governing standard. Each yoke shall be designed to permit vertical removal of the slide. Actuators shall be mounted so that no eccentric loads are transmitted to the yoke.

2-5.02. Slides. Slides shall be at least 1/4 inch thick and shall be provided with welded stiffeners to limit deflection to 1/360 under the maximum seating or unseating head indicated in the Slide Gate Schedule. Slides shall be adequately reinforced to withstand, without permanent distortion, the maximum thrust which can be transmitted by the operating stem. Each slide shall have a reinforced pocket or an internally threaded nut welded to the slide for connection of the stem. The pocket or nut shall be designed to withstand the maximum thrust which can be transmitted by the operating stem.

2-5.03. Closures. The bottom of each slide gate frame shall be recessed so that the waterway is not obstructed. A compressible seal shall be securely attached to the bottom of the slide or to the frame invert. The seal shall be of sufficient length to seal the bottom corners of each slide.

Where indicated, gates shall be provided with resilient hollow bulb J-seals attached to the frame members.

For weir service, slides may be lowered below the bottom of the opening. A frame member shall be provided at the bottom of the opening to seal the space between the slide and the adjacent concrete. The side guides shall be extended below the bottom of the wall opening. A resilient hollow bulb J-seal shall be attached to the frame along the invert of the opening and up both sides to seal the slide in any positions.

Each J-seal shall be provided with a full-length retainer bar which shall compress the seal and prevent leakage between the seal and the frame member. The method of attachment of J-seals to frame members shall permit replacement of the seals without disassembling or removing the gate.

An acceptable alternative to J-seal is a UHMW polyethylene seal/seat. A UHMW polyurethane seat/seal extruded shape shall fit into a dovetail grove in the guide section, and shall seal on both upstream and downstream sides of the slide. The seat/seal system shall act as both a bearing surface and as a seal, and the seal system shall be self-adjusting. The seat/seals shall be easily replaced without removing the gate from the wall. For flush bottom application, the invert shall have a replaceable resilient neoprene seal mounted on the frame invert.

2-5.04. Operating Stems. Operating stems shall conform to the requirements of Section 4.3.6 of the governing standard. Contact surfaces of threads shall be rolled or machined to a 63 microinch finish, or smoother. Each stem shall be securely attached to the slide.

2-5.05. Stainless Steel. All stainless steel shall be pickled in accordance with ASTM A380 at the mill before being shipped. Pickling shall produce a modest etch and shall remove all embedded iron and heat tint. After fabrication, pickled surfaces shall be subjected to a 24 hour water test or a ferroxyl test to detect the presence of residual embedded iron. All pickled surfaces damaged during fabrication including welded areas shall be repickled or passivated in accordance with ASTM A380 as needed to remove all traces of iron contamination. All stainless steel surfaces shall be adequately protected during fabrication, shipping, handling, and installation to prevent contamination from iron or carbon steel objects or surfaces.

2-6. ACTUATORS. Actuators and their accessories shall be the type as indicated in the General UV Requirements section.

Stem covers for manual actuators shall be UV resistant clear plastic, polycarbonate, or steel pipe as indicated in the Slide Gate Schedule and as specified in the Valve and Gate Actuator section.

2-7. SHOP PAINTING. All surfaces of aluminum which will be in contact with concrete, mortar, grout, or dissimilar metals shall be given a coat of epoxy enamel or coal tar epoxy. The epoxy coating shall be NSF certified for gates installed in a potable water facility.

2-8. SHOP TESTING. Gates shall be completely assembled in the shop to ensure that all parts fit together properly.

PART 3 - EXECUTION

3-1. INSTALLATION. Slide gates and appurtenances will be installed in accordance with the Gate Installation section.

3-1.01. Installation Check. An experienced, competent, and authorized representative of the manufacturer shall visit the site of the Work and inspect, check, adjust if necessary, and approve the equipment installation. The representative shall be present when the equipment is placed in operation in accordance with Startup Requirements section, and shall revisit the jobsite as often as necessary until all trouble is corrected and the equipment installation and operation are satisfactory in the opinion of Engineer.

The manufacturer's representative shall furnish a written report certifying that the equipment has been properly installed and lubricated; is in accurate alignment; is free from any undue stress imposed by connecting piping or anchor bolts; and has been operated under full load conditions and that it operated satisfactorily.

All costs for these services shall be included in the contract price. Contractor shall include a minimum of 2 day(s) and 1 trip(s) to the site.

End of Section

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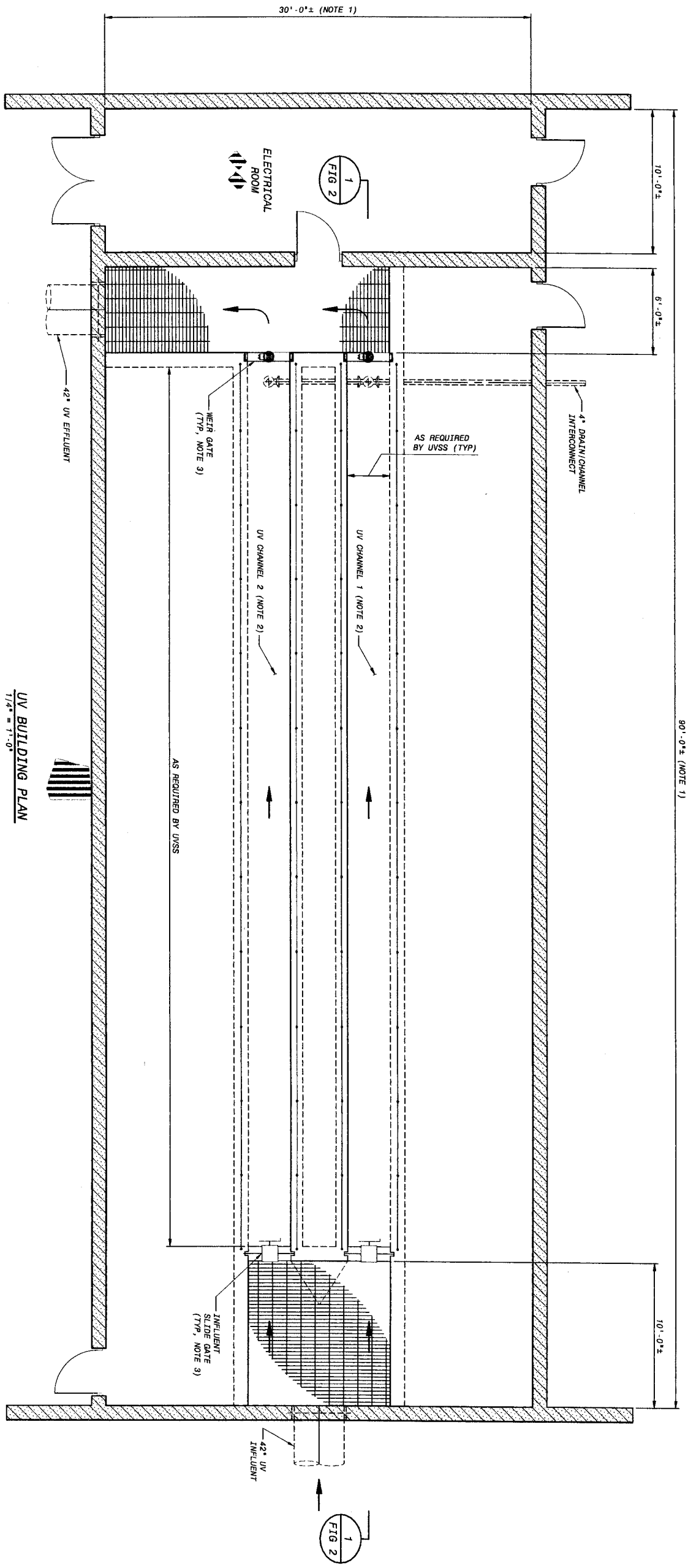

UV BUILDING PLAN
1/4" = 1'-0"

NOTES:

1. BUILDING DIMENSIONS ARE APPROXIMATE AND WILL BE FINALIZED UPON SELECTION OF A SUPPLIER.
2. UV EQUIPMENT VARIES BY MFR, SEE SECTION 13700P, 13701P, 13702P, 13703P AND 13704P.
3. SEE SECTION 15114.

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Two Working Days Before You Dig
ARIZONA BLUE STAKE, INC.
CALL COLLECT
263-1100

FIG 1

SHT. ____
OF ____

091033

ARWRF UV REPLACEMENT & WELL 43 VFD INSTALLATION
UV BUILDING
PRELIMINARY PLAN

PRELIMINARY - NOT FOR CONSTRUCTION

NO.	DATE	DESCRIPTION

REVISIONS

DESIGNED AJM
DRAWN AJM
CHECKED AJM

CITY OF GLENDALE
ENGINEERING DEPARTMENT
5850 W. GLENDALE AVE.
GLENDALE, ARIZONA 85301 (623) 930-3630

D166456
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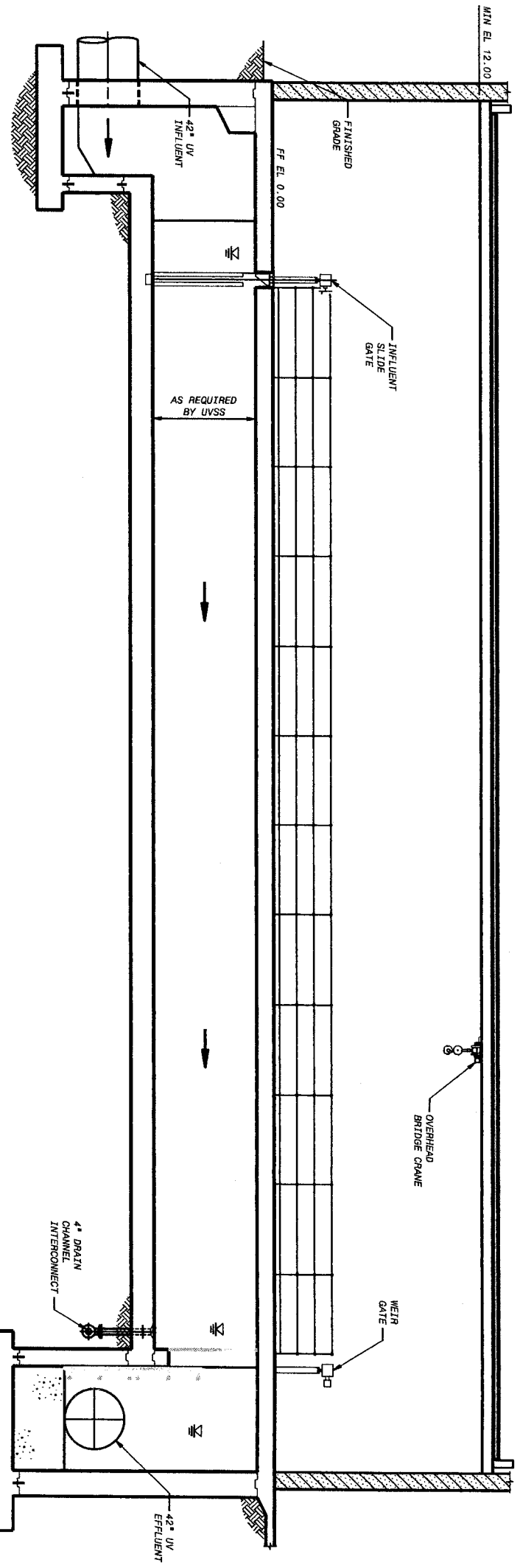

UV BUILDING SECTION
1/4" = 1'-0"
FIG 1

NOTE:
1. TYPICAL OF 2 UV CHANNELS.

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263-1100

FIG 2

091033

ARWRF UV REPLACEMENT & WELL 43 VFD INSTALLATION
UV BUILDING
PRELIMINARY SECTION

NO.	DATE	DESCRIPTION

REVISIONS

DESIGNED AJM
DRAWN AJM
CHECKED AJM

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ENGINEERING DEPARTMENT
5850 W. GLENDALE AVE.
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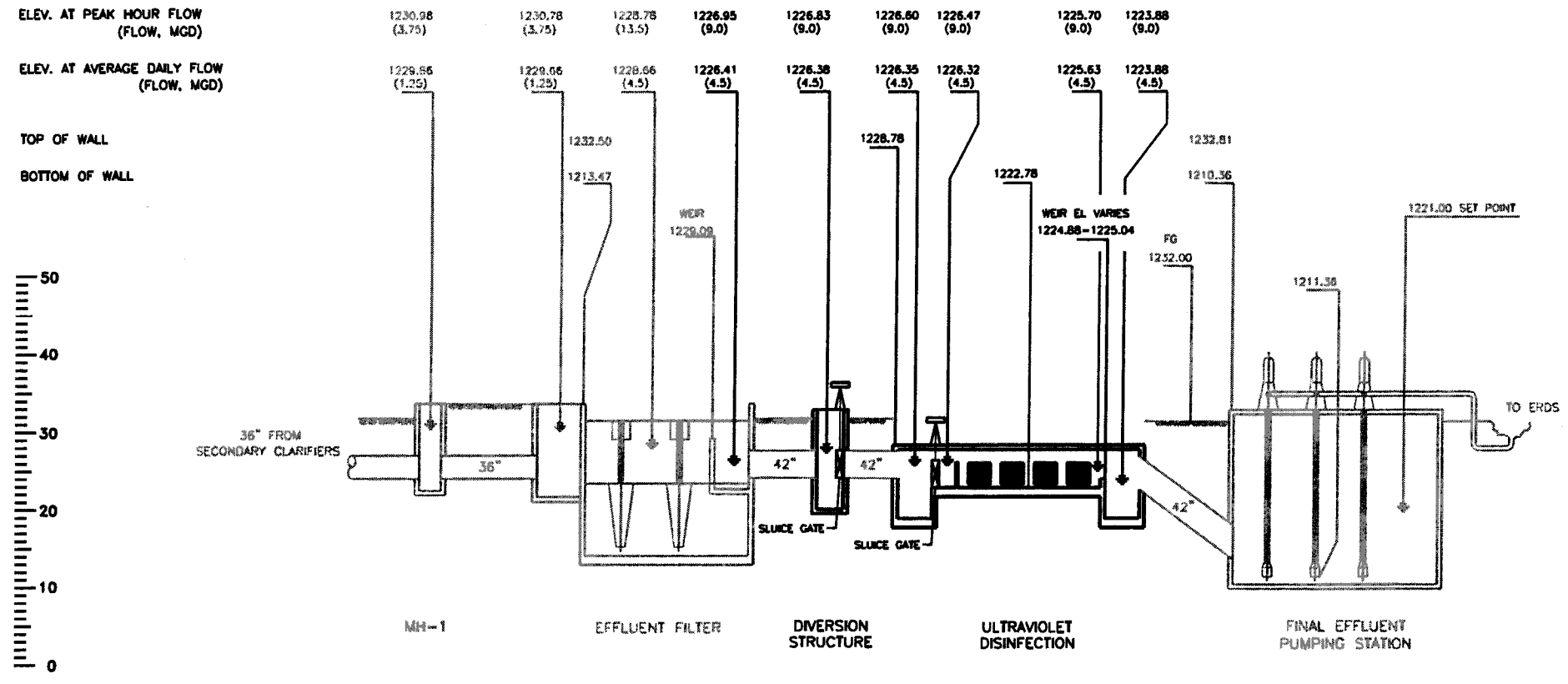

VERTICAL SCALE 1:10
HORIZONTAL SCALE NTS
(DWG SCALED .1X)

NOTES:

1. ELEVATIONS SHOWN ARE PRLIMINARY AND WILL BE FINALIZED DURING DETAILED DESIGN.

D186455
D186456

USER: DR101229 DRAWING VER.: 1 XREF 1: D7000.dwg XREF 2: XREF 1: XREF 2:

FILE NAME: PW FLDR: 169535...\50.3130 - Civil Drawings
REVISION DATE: DRI01229, 1/12/2011 4:13:42 PM
PLOTTING DATE: DRI01229, 1/12/2011 4:13:17 PM
SW VER: PW FILE: Hyd. Profile.dwg PROJECT: 169535

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DESIGNED AJM | DRAWN DMD | CHECKED AJM

NO.	DATE	REVISIONS	DESCRIPTION
1			
2			
3			
4			

091033
ARWRF UV REPLACEMENT & WELL 43 VFD INSTALLATION
HYDRAULIC PROFILE

FIG 3

Arizona Blue Stake, Inc. CALL FOR THE BLUE STAKES 263-1100 ALL OTHER COUNTIES CALL COLLECT

SHT. XX
OF XXX

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GENERAL NOTES:

1. SEE LEGEND ON DRAWINGS I601 AND I602.
2. SYSTEM CODE IS UV UNLESS OTHERWISE NOTED.
3. FOR DRAWING CLARITY, VALVE TAG NUMBERS ONLY SHOW THE SEQUENCE NUMBER UNLESS OTHERWISE NOTED.
4. NOT ALL CONTROL AND INDICATING DEVICES ARE INDICATED. FOR ADDITIONAL REQUIREMENTS, REFER TO THE ELECTRO-HYDRAULIC ACTUATOR SPECIFICATION.
5. THE UV SYSTEM SUPPLIER SHALL CONFIGURE THE UV PLC FOR BLOCK TRANSFER OF INFORMATION BETWEEN THE UV PLC AND THE PLANT CONTROL SYSTEM.
6. ONLY I/O REMOTE FROM THE UV SYSTEM ENCLOSURE IS INDICATED.

ULTRAVIOLET DISINFECTION FACILITY

PLC - UV DISINFECTION SYSTEM

UV SYSTEM CONTROL CENTER

FROM SECONDARY CLARIFIERS

GATE ACTUATOR (HS 01B, HS 01A, OSC, LOR, YA 01, ZT 01)

GATE NO. 1 IN-REMOTE
GATE NO. 1 ALARM
GATE NO. 1 POSITION FEEDBACK
GATE NO. 1 POSITION CONTROL

AE 01, AIT 01 — UV SYSTEM INFLUENT TRANSMITTANCE

GATE ACTUATOR (HS 02B, HS 02A, OSC, LOR, YA 02, ZT 02)

GATE NO. 2 IN-REMOTE
GATE NO. 2 ALARM
GATE NO. 2 POSITION FEEDBACK
GATE NO. 2 POSITION CONTROL

G01, G02 — M

UV-01

AE 01A, AIT 01A — AE 02A, AIT 02A — UV TRAIN 2 REACTOR 1 TRANSMITTANCE

AE 01B, AIT 01B — AE 02B, AIT 02B — UV TRAIN 2 REACTOR 2 TRANSMITTANCE

AE 01C, AIT 01C — AE 02C, AIT 02C — UV TRAIN 2 REACTOR 3 TRANSMITTANCE

LE 01, LIT 01 — LE 02, LIT 02

LSL 02 — UV SYSTEM NO. 2 CHANNEL EFFLUENT LEVEL SIGNAL

LSL 01 — UV SYSTEM NO. 1 CHANNEL EFFLUENT LEVEL SIGNAL

I/O TYPICAL FOR 2 UV REACTORS

G05, G04 — M

G06

GATE ACTUATOR (HS 04B, HS 04A, OSC, LOR, ZSC 04, ZSO 04, ZT 04)

UV SYSTEM NO. 2 CHANNEL OUTLET GATE OPEN CMD
UV SYSTEM NO. 2 CHANNEL OUTLET GATE CLOSE CMD
UV SYSTEM NO. 2 CHANNEL OUTLET GATE IN-REMOTE
UV SYSTEM NO. 2 CHANNEL OUTLET GATE OPENED
UV SYSTEM NO. 2 CHANNEL OUTLET GATE CLOSED
UV SYSTEM NO. 2 CHANNEL OUTLET GATE POSITION

GATE ACTUATOR (HS 05B, HS 06A, OSC, LOR, ZSC 05, ZSO 05, ZT 05)

TO EFFLUENT STRUCTURE

UV SYSTEM NO. 1 CHANNEL OUTLET GATE OPEN CMD
UV SYSTEM NO. 1 CHANNEL OUTLET GATE CLOSE CMD
UV SYSTEM NO. 1 CHANNEL OUTLET GATE IN-REMOTE
UV SYSTEM NO. 1 CHANNEL OUTLET GATE OPENED
UV SYSTEM NO. 1 CHANNEL OUTLET GATE CLOSED
UV SYSTEM NO. 1 CHANNEL OUTLET GATE POSITION

FILE NAME: PW FLDR: I69535...\50-3130 - CIVIL DRAWINGS\
REVISION DATE: DRI01229, 1/12/2011 4:13:42 PM
PLOTTING DATE: DRI01229, 1/12/2011 4:13:17 PM
SW VER: PW FILE: Hyd_Profile.pwp PROJECT: I69535

FIG 4

SHT. XX OF XXX

263-1100

091033

ARWRF UV REPLACEMENT & WELL 43 VFD INSTALLATION
PRELIMINARY UV P&ID

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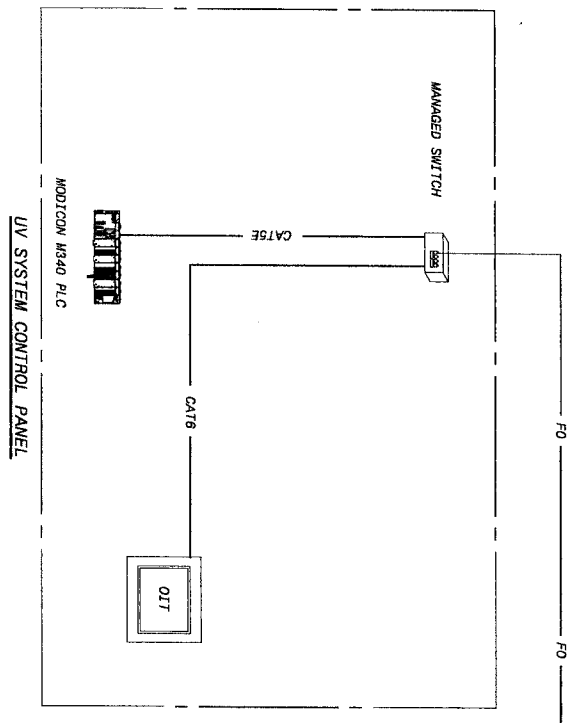
D166456 USER: DRI01229 DRAWING VER.: 1

XREF 1: D7000.dwg
XREF 2:

XREF 1:
XREF 2:



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PLOTTING DATE: DRI01229, 1/12/2011 4:15:17 PM
SW VER: PW FILE: HYD_Prof PW PROJECT: I69535

FIG 5

091033

ARWRF UV REPLACEMENT & WELL 43 VFD INSTALLATION
PRELIMINARY NETWORK DIAGRAM

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263-1100

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